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Register, Journal,

AND

GAZETTE,

JULY 6TH — DECEMBER 28TH, 1850.

EDITED BY J. C. ROBERTSON.

VOL. LIII.

"Crowns have their compass; length of days their date;
Triumphs their tomb; felicity her fate:
Of nought but earth can earth make us partaker,
BUT KNOWLEDGE MAKES A KING MOST LIKE HIS MAKER."

Shakspere (Collier's Edition).

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1850.

ALPHABETICAL LIST OF NEW PATENTS GRANTED FOR ENGLAND, SCOTLAND, AND IRELAND.

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Ablon	Increasing draught in chimneys	....	16 October	31 July	359,200
Adorno	Cigars	31 July	....	....	100
Ainslie	Bricks, tiles, &c.........	30 Nov.	....	....	440
Allan..	Electric telegraphs	16 Nov.	....	....	420
Allemand......	Producing light	14 Nov.	....	....	400
Amberger ..	Applying magnetic power to motive purposes	3 October	....	....	280
Anderson......	Spectacles	30 Nov.	....	....	440
Anderson.......	Soap-making	....	7 Nov.	....	519
Ashe...........	Nautical instruments	14 Nov.	....	....	400
Atwood	Copper tubing..........	....	6 Sept.	18 Sept.	260,280
Auld..........	Steam engines and boilers.	19 Dec.	....	....	499
Babington ..	Preventing incrustation in boilers..........	7 Nov.	....	....	380
Bachhoffner and Defries.	Obtaining light and heat..	19 Dec.	....	....	499
Baddeley	Ornamental earthenware..	17 October	....	....	320
Baldwin and Collier	Carpets	12 Dec.	....	....	480
Ball..	Heating ovens	12 Nov.	....	....	400
Bancks........	Paper	30 Nov.	....	....	440
Barans........	Axles, axle-boxes, &c....	....	....	1 August	200
Barclay	Smelting iron; rotary engines and fans....	5 Sept.	....	....	200
Barber	Reels, stands and desk seals	30 Nov.	....	....	440
Barlow........	Spinning cotton	17 October	....	....	320
Barlow and Barlow....	Railways	....	22 July	5 October	80,360
Bateman	Life-boats	2 Nov.	....	....	379
Baxter	Lifting apparatus	12 Dec.	....	....	480
Beart	Bricks and tiles	10 October	....	....	299
Beatson	Taking and measuring angles	....	29 July	....	179
Beattie........	Steering vessels	5 Sept.	14 October	....	200,359
Beetson	Waterclosets, pumps, and cocks	23 July	....	....	79
Bell........	Waterclosets, and gas and air-traps	25 July	14 August	....	79,180
Bendall	Agricultural implements ..	23 Nov.	....	....	440
Bennett	Doors, window-shutters and blinds	12 Dec.	....	....	480
Bernard	Pneumatic springs	3 October	....	....	280
Bernard and Dureñille..	Boots and shoes.........	4 Dec.	....	....	460
Bessemer......	Ornamenting surfaces....	22 July	....	....	79
Bessemer......	Centrifugal apparatus....	31 July	....	....	100
Black	Folding machine........	7 Nov.	....	....	380

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Harratt........	Rolling iron...........	28 Sept.	....	....	280
Harris	Barometers	19 Dec.	....	....	499
Hayden	Drawing frame regulator..	10 October	....	....	300
Hazeldine	Wagons, carts, and vans .	23 July	....	....	79
Helbrunner ..	Excluding air, dust and noise from apartments	31 July	11 Nov.	....	100,519
Highton	Electric telegraphs......	....	21 August	17 Oct.	180,360
Hill	Preparing cotton........	15 July	....	....	60
Hinley	Castors.	5 Dec.	....	....	460
Hoby	Railways..............	3 July	....	15 July	20,80
Hoby	Railways..............	7 Dec.	....	....	480
Hodge	Steam engines and agricultural machines ..	3 July	....	....	20
Hodgkinson....	Furnaces, and pig-iron ..	2 Nov.	....	....	379
Hall..........	Steam engines.........	12 August	16 August	....	140,180
Holland	Umbrellas and parasols...	22 August	....	....	160
Holliday	Lamps	....	14 August	....	180
Hornsby	Agricultural machines, steam engines, & boilers	July 3	....	....	20
Horsfall & James	Rolling iron	....	6 Sept.	....	260
Hosking	Valves, pumps, &c.......	19 Nov.	....	....	420
Houldsworth ..	Iron and metals	26 Sep.	28 August	....	260
Howarth..	Raising nap or pile......	14 Nov.	....	....	400
Howells	Gun carriages	12 Dec.	....	....	480
Huddart	Cigars................	29 August	14 August	16 Aug.	179,180 200
Hurwood	Grinding corn...........	....	11 Nov.	....	519
Hutchinson....	Sawsets, mallets, &c.....	....	28 August	....	260
Hynam	Match and taper dipping..	31 July	....	....	100
Illingworth	Preparing	22 August	....	....	160
Jackson	Heckling	....	....	17 July	80
Jacobs	Printing, colouring, and shading	24 Oct.	....	....	340
Jennings	Waterproofing canvas and leather	23 July	....	....	79
Johnson	Fixing colours on cotton, &c............	17 October	15 Nov.	....	320,520
Johnson	Steam engines, boilers,&c.	12 Dec.	....	....	480
Kane	Chairs, castors, and presses............	5 August	....	....	120
Keates	Rollers and cylinders	16 August	4 Oct.	....	140,359
Keely and Wilkinson	Looped fabrics	....	....	3 August	200
Kingsford	Refrigerating	3 July	....	....	20
Knowles	Charcoal	9 Nov.	....	....	400
Kurtz	Dyeing................	19 Nov.	15 Nov.	....	420,520
Laird and Cowper ..	Loading and unloading ships	16 Nov.	....	....	420
Lamport	Raising weights	....	2 Sept.	....	260
Lancaster....	Firearms, cannon and percussion tubes....	3 July	21 August	....	19,180
Longdon and Tabberer ..	Looped fabrics	12 Sept.	....	....	220
Legras	Disinfecting, manures, &c.	....	....	3 August	200
Leigh	Preparing and spinning ..	....	25 Sept.	....	359
Lerew	Sewing-machines	7 Nov.	....	....	380

INDEX

TO THE FIFTY-SECOND VOLUME.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1404.] SATURDAY, JULY 6, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

GRIMSLEY'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF BRICKS AND TILES.

Fig. 11.

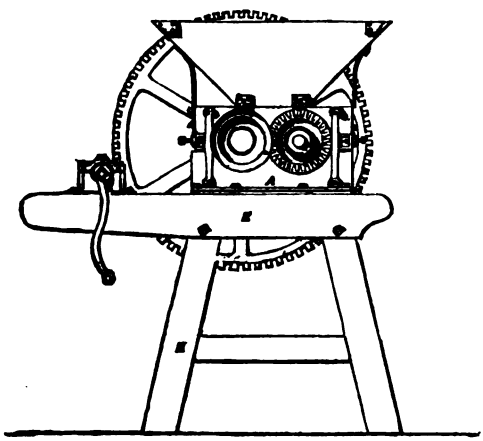


Fig. 12.

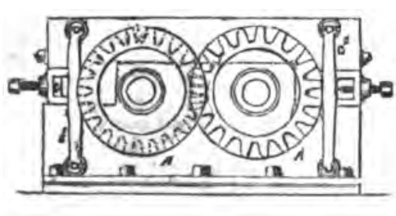


Fig. 13.

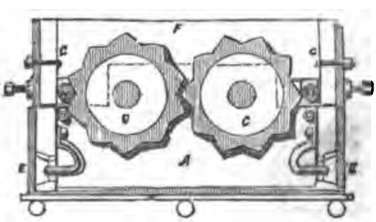


Fig. 14.

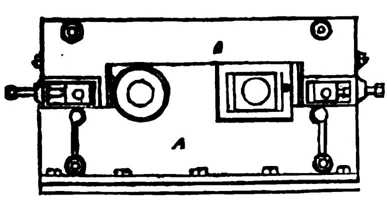
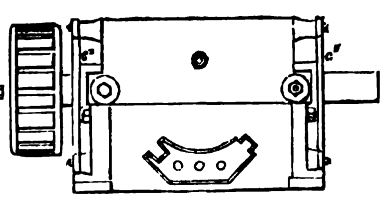


Fig. 15.



GRIMSLEY'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF BRICKS AND TILES.

(Patent dated December 10, 1849. Patentee, Thomas Grimsley, of Oxford, Sculptor. Specification enrolled June 10, 1850.)

Specification.

Firstly. My invention consists of certain improvements in machinery for the manufacture of bricks and tiles.

Fig. 1 is a side elevation, and fig. 3 a front view of a machine adapted to the making of bricks of the particular forms separately shown in fig. 2. The brick here delineated is made concave on its upper surface, and on one of its sides and on one of its ends there are formed grooves *a a*, while on the other side and end it has projecting tongues *b b*, so that when several rows of such bricks are placed side by side and end to end, the tongues of each brick take into and fill the grooves of the two next adjoining bricks, or *vice versâ*. Each brick has also three or more holes *c c* made right through it from end to end, which, besides being attended with a saving of material, serve to facilitate both the drying and the firing. A A is the principal framework of the machine; B a chamber for clay; J a die plate; and *a a* (see fig. 3) a core or mandril in the mouth of this plate, by which the longitudinal holes *c c*, before mentioned, are produced. C is the piston of the cylinder, which is worked by means of the rack D and pinion E; F a pinion which gears into a spur wheel G, affixed to the same shaft as the pinion E; and F^2 a crank handle by which the driving power is applied to the pinion F. H H is a travelling bed, composed of a number of plates or boards, which are pushed in beneath the cylinder one after the other, according as they are required to receive the moulded materials on issuing from the die plate J. K K K are a set of rollers which have their bearings in the framework A A, and carry the plates or boards of the travelling bed. L L are a set of smaller rollers, which convey the moulded clay from the die plate J on to the travelling bed; these rollers may be dispensed with when the lower edge of the die plate is near to the bed. A^2 A^2 is an additional framework (a front view of which is given separately in fig. 4), which is mounted on the top of the principal framework A A, and carries the cutting apparatus. This apparatus consists of a series of frames N, N, N, each carrying a steel wire *n*, *n*, *n*. O O are guide plates, placed one on each side of the frame A^2: these plates have a set of slots n^2, n^2, n^2, cut in them, which correspond with the number of the frames N, N, N, and are placed immediately underneath them, so that when the frames are allowed to drop down for the purpose of the wires *n*, *n*, *n*, cutting the moulded clay into the proper lengths, the wires fall into the slots, and are made thereby to descend in a waving line, and consequently to cut the ends of the bricks in a waved line, instead of straight through (as they otherwise would be if there were no guides). The waved line, which is represented in the figure, corresponds to the groove and tongue formed on the edges of the brick, as before explained. As each plate or board becomes filled with the moulded bricks or tiles, it is removed, and fresh ones supplied underneath the cylinder, as already explained.

Should it be desired to make the grooves and tongues of a circular curve corresponding, for example, to the top concave surface, I employ a cutting apparatus—such as is represented in figs. 5 and 6, the former being a side elevation, and the latter a front elevation of it. A A are two side standards or supports, which carry a cross spindle B, upon one end of which there is fixed a crank-handle C. D D are a set of cutters, which are affixed to a frame attached to and moving along with the spindle B; each of the cutters is bent at *a*, *a*, *a* into the form which it is intended to give to the grooves and tongues. The cross spindle B occupies a position immediately over the travelling bed and parallel with the line in which the moulded clay is travelling, and at such a distance above it that, as the cutters are made to oscillate from one side of the machine to the other, they may be made, by turning the crank handle C, to pass through the moulded mass, and cut it into the required lengths. As the cross spindle B may be moved higher up or lower down in the standards A A (its bearings being fixed in slots in these standards), the curvatures given to the groove and tongue can readily be made to correspond with the concave surface of the brick.

[The patentee next describes another form of cutting apparatus, in which a simple cutter is used, but its movements are effected and regulated by the progression of the moulded materials.

Fig. 11 to 15, both inclusive, exhibit another arrangement of machinery for pressing clay through dies into the form of bricks or tiles. Here, as in the preceding case, an uniform and continuous discharge of the moulded clay from the die-plate, in a state ready for being cut into lengths, is produced. A A is the clay chamber, which is affixed upon a framework B. C C are two rollers which have longitudinal teeth and grooves of a peculiar shape cut upon their peripheries, and are mounted in such relative positions that the teeth or pro-

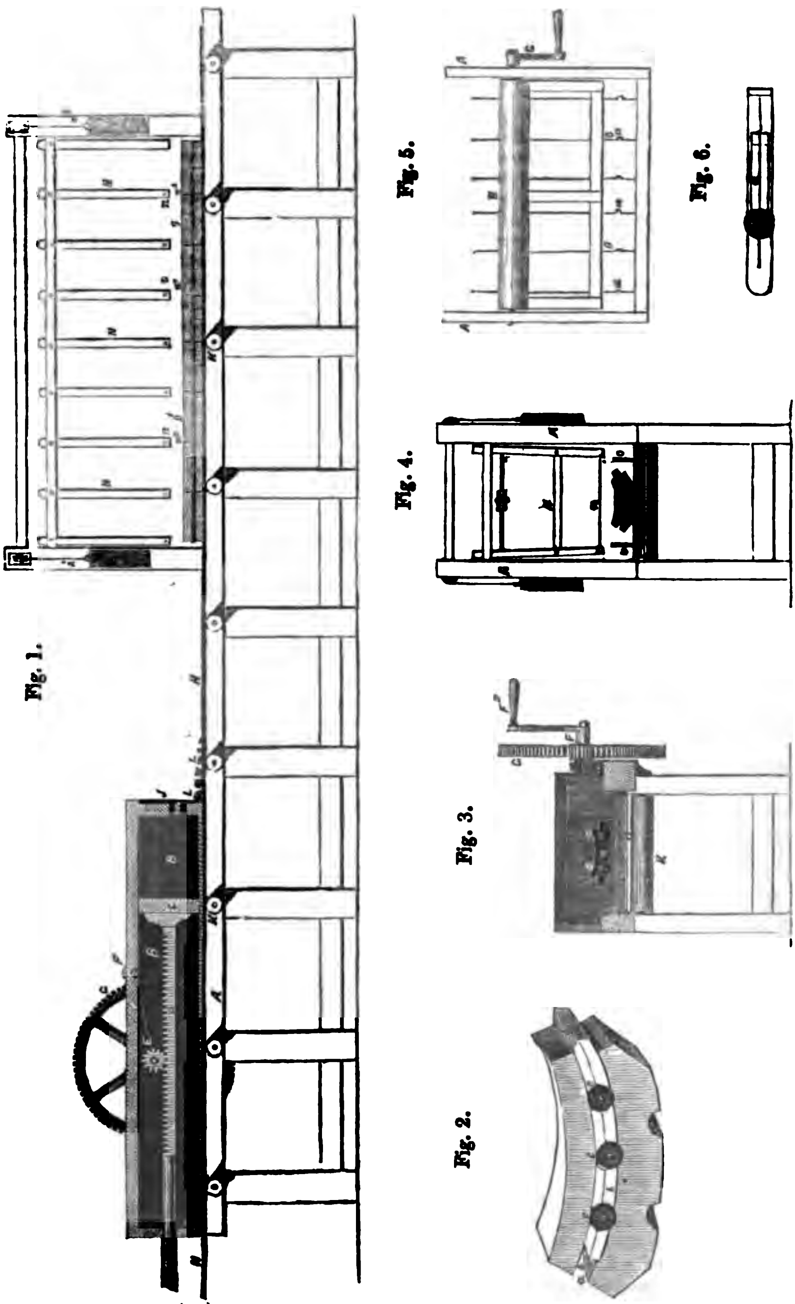


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.

jections of the one roller shall gear or take into the grooves in the other. The bearings of these rollers are made capable of being moved by means of screws at D, so that their teeth may be made to gear more or less closely into their corresponding grooves according as the clay to be moulded is more or less free from grit. E is the die-plate of the machine, F the hopper, G a sliding frame which rests upon and is affixed to the upper edge of the clay chamber by means of jointed links, G^2G^2, by which it is allowed to slide freely backward and forward upon its seat. H H are two small rollers which have their bearings in the sliding frame G, and are interposed between the teeth of the rollers C C, and the ends of the sliding frame to prevent any escape of clay at that part. The teeth of the rollers are (as shown) straight on one side, but curved on the other side, and this shape is given to them in order that the smaller rollers may keep constantly in contact with the sides of the teeth of the rollers C C; the convexity or curvature on the one side of the teeth forming a compensation for the difference in length between the teeth of the rollers in different positions, which difference arises from the outer ends of the teeth moving in a larger circle than their inner ends. Clay being fed into the hopper, it is drawn down by the teeth of the rollers, and when the chamber is full it can only find a means of escape through the die-plate. The smaller rollers always keep in close contact with the teeth of the rollers, which causes an oscillating or to and fro motion to be given to the sliding frame G, and thus keeps the clay constantly feeding into the rollers.

Fig. 24.

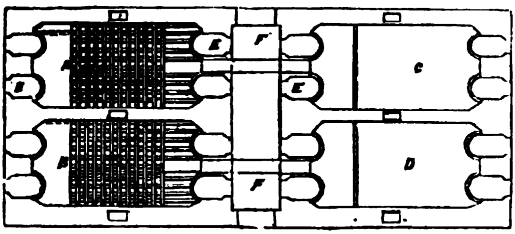


Fig. 25.

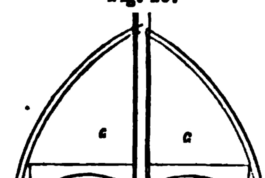
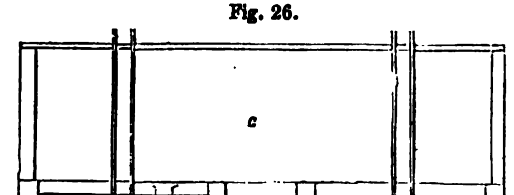


Fig. 26.



The machine, when employed without a die plate, may be used for crushing, breaking up, and pugging the clay to be subsequently used in making bricks and the finer qualities of tiles; the peculiar form of the teeth admitting of the rollers working very close upon each other.

Secondly. My invention consists in covering such bricks or tiles as are employed in the construction of drains, sewers, and other conduits of liquids and liquid matters with a glazing upon those parts of their surfaces over which the liquid or liquid matters are designed to flow, by which the force of the current flowing through the drains or sewers will be much less impeded, while the structure will at the same time be rendered more lasting. A brick, of the form first hereinbefore described (and represented in fig. 2), would, for example, be covered with the glazing upon the upper concave surface. I employ for this purpose any of the common sorts of glazing now used for covering the surface of earthenware by vitrification.

Thirdly. My invention consists of certain improvements in the mode of drying and firing bricks and tiles. Fig. 24 is a plan, fig. 25 an end elevation, and fig. 26 a longitudinal section (all the figures being partly in section) of a kiln composed of four compartments A, B, C, and D, in which the bricks or tiles are first partly dried and then fired. E E are the furnaces, of which there are two sets for each of the compartments (A, B, C, and D,) which are thus fixed from both ends. F F is a passage between the two chambers formed at each end of the kiln, which serves for getting to the furnaces at the inner ends of the firing chambers. G is a drying-room, which is formed over the top of the kiln and communicates with the firing chambers by openings or doors in the roof of the latter. The method of working this kiln is as follows:

Supposing the whole of the chambers to be filled with bricks or tiles, and that those in the chamber A are to be "fired;" the fires are lighted at both ends of the chamber. The heated vapours pass up through the bricks or tiles at the two ends, then descend through those placed in the central part of the chamber and escape by openings or flues formed below the floor of the chamber, whence they are conveyed into the other chambers; after circulating through which in the same manner (namely, ascending at the two ends and descending in the middle), they are allowed to escape from the last of the series into the drying-room. Each chamber has its separate openings into the chimney, and its separate flues leading into the other chambers; and the whole are fitted with dampers so that any chamber can be made to communicate to, or be stopped from communicating with, the others at pleasure. By being thus enabled to work any two or three, or the whole of these chambers at the same time, a great saving of fuel is effected, as in the first place it is only necessary to fire the chamber or chambers intended to be put in actual use, and the firing of these chambers serves to dry or prepare the materials in the other chambers to be fired in their turn.

INSUBMERGIBLE BOATS.—WATER-TIGHT COMPARTMENTS.

There is perhaps more merit in adopting and practically exhibiting the useful inventions of another than in being the originator of them; thus Mr. Bonney's insubmergible vessel does him equal credit, at least, whether the idea of water-tight compartments at the sides of a vessel was from the first his own, or whether he profited by an article in the *Mechanics' Magazine* of October 7, 1848. In p. 351 of that publication, amongst other notes of improvements in shipbuilding devised by Sir Samuel Bentham, it is stated, that "the sides of a ship, and the bulkheads themselves, should be composed of a kind of cistern."

Sir Samuel in all his contrivances endeavoured to continue as many advantages as possible; thus these cisterns, or water-tight cases, as he designed them, would afford great strength to the vessel, and, under ordinary circumstances, they would be "used for water, for dry provisions, or for other articles of store," but that they might "in cases of emergency be emptied of their contents, and thus give a very material additional amount of buoyancy to the vessel."

Mr. Bonney has also given stability to his safety yacht by the means indicated by Sir Samuel, p. 352, of the same number of the Magazine, namely, that "the great quantity of iron now used as ballast, and nowise contributing to strength of structure, should in all ships be made to form a part of the vessel itself, so as to give it strength." Mr. Bonney has adopted this principle in his iron keel and keelson.

This gentleman appears not to have extended his ideas of improvement beyond boats, small craft, and yachts; Sir Samuel conceived that water-tight compartments along the sides of vessels and in their transverse bulkheads, were applicable as well to ships of the largest size, and equally advantageous for vessels of war, for merchantmen, and for navigable vessels generally, large and small, and whatever might be the description of service required from them.

Water - tight compartments have already saved many iron-built vessels from destruction; they afford means of bringing a vessel at pleasure, more or less, by the head or stern; they are continually held forth in recommendation of vessels possessing them, as affording acknowledged means of security; they are enjoined by Act of Parliament in regard to all iron-built steamers—yet, strange to say, they are not adopted in vessels built of wood.

It was, however, in vessels built entirely of wood that water-tight compartments were first introduced—in the experimental vessels built by Sir Samuel Bentham in the year 1795. The advantages of those compartments, and of the fixed bulkheads forming them, as exemplified in those vessels, were laid before the Committee on Finance, 1798; and it is certain that they contributed materially to the strength of the *Dart*, as stated in the official Reports of Shipwright Officers, 1803, and of the Surveyor of the Navy. The importance of this improvement has since that time been also repeatedly brought to notice in a variety of publications; yet to this day it has not been adopted in vessels built of wood. To what circumstance can this neglect of water-tight compartments be attributed?

Is extra cost in the construction of a vessel apprehended?—If this be the objection, it is fallacious. The quantity of timber necessary for fixed bulkheads can in no way contribute more to strength than in the formation of such partitions; they tie together the bottom of a vessel, its sides, and the decks, and thus prevent racking.

Is it any supposed inconvenience?—Bulkheads of some sort are usual in vessels for all services. Bulkheads forming water-tight compartments may be disposed in any part of a vessel as may be most convenient for stowage or for habitation; they may be only transverse as in Sir Samuel's schooners, or they may be both transverse and longitudinal, as in the *Arrow* and the *Dart*.

Is it that they cannot be made water-tight?—What is there to prevent it? Why is it more difficult to construct a close-fitting partition than the outer shell of a vessel? Why less easy to caulk an internal surface of wood than a vessel's hull?

Is it that a wooden vessel never has a dangerous single hole pierced in her bottom by a rock, never has a rotten plank that lets in water at some one particular place? Nautical records and the daily papers tell of many a vessel built of wood, that has foundered in consequence of some such partial defect in her hull; of many more instances where stores have been damaged by the spread over a whole cargo of some partial leakage.

Or is it that a habit of adherence to old methods of construction, has been the bar to this innovation? If this be the obstacle, it may be hoped in this age of progress, that old methods will be discarded in naval architecture, as they have been in so many other arts.

But whatever objections to water-tight compartments may have presented themselves to any of your readers, a statement of those objections in your pages might bring to light what now is in obscurity; —might bring unseen difficulties to view, and thus tend to the contrivance of some mode by which they might be obviated.*

M. S. B.

EFFECTS OF SHOT ON IRON SHIPS.

"The first experiment for testing the effect of shot and shell on the sides of iron vessels, took place on Wednesday week, at Portsmouth, under the superintendence of Capt. Chads, on board the *Excellent*. The Commander-in-Chief, Admiral the Hon. Sir Bladen Capel, Rear-Admiral Prescott, and a number of naval and military officers were on board her. A large butt, being a copy of a section of the *Simoom's* main deck, had been made in the dockyard, representing the two sides of an iron vessel, each side of the strength and consistency of one of the large iron steam-ships. This butt was erected on the mud, at a distance of 460 yards from the *Excellent*,—and the practice took place at high water; from guns of several calibre and various charges of powder, both shot and shell were fired. At intervals between the firing, boats visited the butt, to examine the effects of particular shot on the iron work. It was found that, on the side which the shot entered, a large and tolerably round hole was made in the iron plate, the circumference being much jagged, and the edge turned inward. On the opposite side, where the shot passed out, the hole was larger, and also jagged, the edge of the whole turned outwards, with occasionally some rivets started. Some of the shot on entering, and from striking against the angles of the iron ribs, were broken in pieces, the fragments passing out at the opposite side, making holes of various sizes and formations. Shells also appeared to have a destructive effect on the iron-work in creating splinters, and the

* It may be right to state that the preceding observations were in our hands prior to the late lamentable wreck of the *Orion*. How the water-tight compartments with which that vessel is *said* to have been provided failed in their object, is a point which remains for inquiry; of the truth of what has been *said* on this head, we have great doubt. Ed. M. M.

pieces of shell passing out through the plates at the opposite side—the off side in all cases suffering most. Of course, neither shot nor shell, nor grape nor canister, would lodge in iron vessels, as would be the case in wooden vessels. To test the effect of the splinters inside the vessel, a slight plank bulkhead had been run up between the iron sides of the butt. This was found entirely shattered."—*Newspapers.*

The above cited experiment, made at the suggestion of Admiral Sir Charles Napier, cannot but be considered as of vast importance to the mercantile no less than to the military marine; it goes to establish that, not only the hull of an iron vessel would be subject to great danger in action with an enemy, but also that her sails, rigging, interior fittings, and crew, would be destroyed by splinters of metal.

On reference to Number 1313, p. 353, of the *Mechanics' Magazine*, it will be seen that the recent experiments at Portsmouth are such as were recommended to the Comptroller of the Navy by Sir Samuel Bentham, so long ago as the year 1810. Then, at the same time that he was indicating that navigable vessels had been already built of metal, and that he was of opinion that this material "might be largely employed in the construction of ships for the navy," he did not fail to represent that "the effect of *shot upon metal* is a point which would require experiments, in order to ascertain the difference that would result in consequence of the non-elasticity of metal when struck by shot; particularly in regard to the size and shape of the aperture made, to what extent beyond it the metal would be likely to be torn, the kind of splinters that would be carried within board, &c. Such experiments would be easily made by firing shot of different sizes, and with different velocities, against plates of metal of different kinds and different thicknesses; which plates, however, should be affixed to a body floating upon water, in order that they might have the same advantage of that slight recoil on the water which would exist in regard to metals employed in vessels for sea service."

The recent experiments at Portsmouth seem to leave no room for cavil, excepting that the butt was a *fixed* one on the mud, so that it was deprived of "the advantages of slight recoil;" and as the Committee on Navy Estimates, 1848, reported that officers who had commanded iron steam vessels under fire were "unanimously in favour of their fitness for war," it still seems desirable that further experiments should be made against a butt floating on water. The question, however, seems to have been virtually set at rest by the Portsmouth experiments; and had Sir Samuel's proposal in 1810 been adopted at that time, instead of this late day, the nation would have been saved not far from a million sterling thrown away, it may be said, on iron vessels of war.

The importance of the recent experiments at Portsmouth to the *mercantile* marine is confined to periods of hostility with foreign nations; but in times of war, in what seas would iron built vessels venture? The stroke of a single shot against an iron hull would amount to almost certain perdition, and rather than run the risk, her colours would be struck on the first summons of an enemy. No longer would a coaster, if of iron, hazard a combat in self-defence; the always heavy item of insurance during war would of course greatly exceed for an iron vessel the rate thought sufficient for one of wood. In regard to the auxiliary defensive force of the country now counted on as surely available from the mercantile marine, it could no longer be depended on from such portions of it as are built of iron.

In the Portsmouth experiments, as stated above, there is a circumstance which points to the need of further trials to ascertain the fitness of iron for such parts of a vessel as her timbers or beams. The *plates* of iron were always pierced by shot and shells, so that no doubt remains on this head, but where a missile struck against *angle* iron it was the *ball* that was broken into splinters.

M. S. B.

PHILOSOPHY OF FIRE EXTINCTION.—THEORY AND PRACTICE.—PHILLIPS' FIRE ANNIHILATOR.

"One of the most extraordinary of all our modern discoveries (provided it prove thoroughly efficient)."—*Dickens' Household Words.*

Sir,—It is pretty well acknowledged, as an established fact, that by the exclu-

sion of air—the common supporter of combustion—fire will be extinguished; and a great deal of ingenuity has been employed to discover the best and readiest mode of excluding air for this object. The popular method (from the time of the flood, at least,) has been by the application of water—a process thoroughly efficient, when properly performed, with this advantage, that the effect is certain, whether the materials are in the state of *flame* or *incandescence*, and re-ignition is prevented. Numerous means have been proposed for increasing the extinguishing power of water by the admixture of salt, alkali, clay, &c., which leave an incrustation after the water has been evaporated by the heated surface. Attempts have been made to effect the exclusion of air by the introduction of steam, carbonic acid gas, &c. Mr. Phillips more recently proposed the use of a humid vapour rapidly and easily generated; but this, like steam, only extinguishes *flame*, leaving the incandescent materials free to re-ignite, to which their hot and dry condition is peculiarly favourable.

Mr. Phillips' plan is before the public by the printed prospectuses issued by the Annihilator Company, and by his lectures and experiments at the Vauxhall Gas-works. The Number of Dickens' "Household Words" for June 15th last, contains a very fair and amusing description of Mr. Phillips' *successful performance at Vauxhall*, and, by a curious coincidence, the *Mech. Mag.* of the same date gives an account of the *signal failure at Woolwich*. In the former case the fire was made, both in *character* and *extent*, to suit the powers of the annihilators; while in the latter case the fire was of the ordinary character, and such as has continually to be dealt with in practice, and for which the *annihilators* proved wholly unfit.

The ratio in which fire is multiplied by time increases variously according to circumstances, but *always in geometrical proportion*; a fact of which Mr. Phillips appears to be ignorant, as he states in his prospectus, that "a fire extinguishable by one gallon of water will, in *five* minutes, require *one hundred* gallons, and in *ten* minutes *one thousand* gallons"—making the progressive increase of the fire in the first five minutes *one hundred* per cent., but in the second five minutes only *nine* per cent.!—an error of serious moment in propounding a plan for fire-extinction.

The extinction of fire by the exclusion of air, although correct in *theory* is extremely difficult, frequently impossible in *practice*. When a fire has broken out in a close apartment, and it has been possible to prevent the entrance of air and the escape of smoke, the fire has been self-extinguished; and several successful operations of this kind have come under my notice, especially in rural districts destitute of fire-engines. The idea of extinguishing fire by excluding air, after a draught has been created, and a free influx of air taken place, is preposterous. In Mr. Phillips' prospectus, however, it is stated that in the event of fire in a railway train (in the open air) "a couple of annihilators carried in the luggage-van will immediately stop all mischief!" In the conclusive experiment at Woolwich, the fire was raging fiercely in the shop when the *humid vapour* was discharged into it from the *annihilator*; but a hundred-fold greater quantity of fresh air was rushing in at the same time through the door and window; no *exclusion of air* could possibly take place, and the *annihilator* was consequently totally useless, although the fire had been burning but five minutes. Mr. Phillips, in his prospectus, says that after a fire has been burning ten minutes, "it is seldom that the efforts of the firemen are efficacious in preserving the premises in which the fire breaks out, although they may prevent its communication to the adjoining buildings." The erroneousness of this statement is shown, by the fact that of the 838 fires in the metropolis during the year 1849, 582 were extinguished in their infancy, and in no less than 228 cases in which the fire had been burning from 20 to 40 minutes, the fire was extinguished, and the efforts of the firemen were efficacious in preserving the premises in which the fire broke out. It continually happens that fires break out in the lower part of a house, which, together with the staircase is enveloped in flames before the conflagration is discovered. Or the fire may be raging in a remote part of an extensive range of warehouses or workshops, where the fire

has attained a great head and free draught of air before the mischief is perceived; in such cases the fire becomes a large one, however prompt the arrival, or successful the application of remedial measures; the fire was a large one before it was discovered.

It is said "we have a well-appointed fire-brigade, with mains, fire-plugs, carriage and floating engines of great power, worked by men of known skill and intrepidity, still the amount of property and life destroyed by fire in this country in any given year is truly awful. How does this happen?" The answer is—from *late discovery* of the mischief. In all cases where a fire is discovered early enough to be extinguished by the fire-*annihilator*—a single pail of water is sufficient for that purpose, and the metropolitan firemen never fail to effect its extinction, in addition to which they are eminently successful in a great number of instances where *annihilators* would be entirely useless. Mr. Phillips, in his lectures, admits that the adoption of his *annihilators* would not supersede any of the present arrangements of water, hose, or fire engines; their services being as necessary as ever to extinguish the red heat, and prevent re-ignition, and preserve adjoining premises from destruction! What then becomes of the boasted exemption from *damage by water?* If water is "imperatively necessary to extinguish the red heat" at last, why not employ it to extinguish the *flame* which it will do at the same time, at first?

Mr. Phillips' glowing picture of the immense advantage of the fire-*annihilator* is founded upon the supposition that the annihilator is on the spot, and that the fire-engine has to be sent for. Now common fairness demands that both should be upon the same footing, both present, or both to be fetched, and the superiority of the *annihilator* then vanishes. One pail of water skilfully applied, is superior in its extinguishing powers to one of Mr. Phillips' annihilators. The *cost* of a machine for projecting the water is about the same, with the advantage of being useful at all times for a great variety of purposes; any quantity of water may be had for nothing, and its application continued until its services are no longer required. The annihilator is expended in a few seconds, and must become cold before it can be again charged—every charge costing *five shillings!*

In a prospectus now before me, the *annihilator* is strongly recommended for the purpose of extinguishing fires in chimnies (red heat)! Would it not be equally prudent and more, much more economical, to *prevent* fires in chimnies by regular cleaning?

Notwithstanding Mr. Phillips' assertion, that "water is comparatively powerless upon violent flames, and therefore inadequate to the task it is called upon to perform," we shall very shortly see such an improvement in the application of this element as will afford the inhabitants of the metropolis an amount of protection against fire, similar to that enjoyed for some time past in Philadelphia, Hamburgh, Liverpool, Oldham, and elsewhere.

In conclusion; if water, after all, is really "powerless upon violent flames," what effect can be expected from *humid vapour* under similar circumstances?

I remain, Sir, yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington, June 27, 1850.

BILBY AND CO.'S CAPSTAN.

Sir,—Permit us to submit to your notice a brief description of a new form of Ships' Capstan, devised by Messrs. Bilby and Co., of Nelson Dock, Rotherhithe, who in employing us to manufacture it, have expressed a wish to render its advantages available to the public.

The capstan is placed on the quarter-deck, or on any platform elevated a few feet above the deck, and is connected by a bevel-wheel and pinion below it, with a winch handle worked by several men. The capstan-head is thus left free to receive a rope in any direction, the men are saved the labour of travelling round with the spokes, and of leaping over the rope at every turn, and the space required for working is greatly reduced.

We are, Sir,

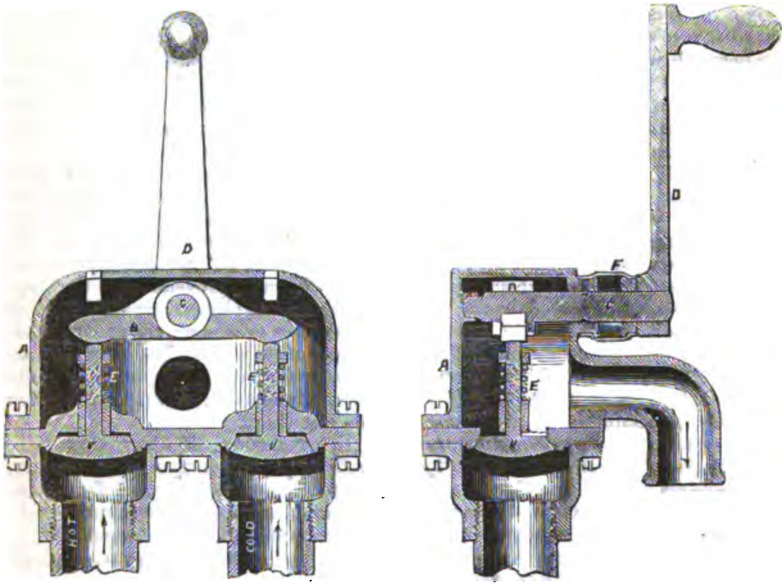
Your obedient servants,

CHARLES COLLINGE AND CO.

65, Bridge-road, Lambeth, July 2, 1850.

POPE'S STOP VALVE.

Registered Under the Act for the Protection of Articles of Utility. Messrs. William Pope and Son, of the Edgeware-road, Engineers, Inventors, and Proprietors.



A is the valve-box; VY the valves, both of which open downwards; B a cross lever that acts on either valve according as it is pressed down at either side by the spindle C; D handle to the spindle C; EE, springs attached to the top of the valves, by which they spring back to their places after the pressure of the lever B on either valve as removed; F a vulcanized collar of India-rubber, by which a water and air-tight junction is made between the spindle C and box A; F, a metal pin, by which the spindle is prevented from sliding on the flange of the box A.

WESTMINSTER BRIDGE.

Our readers will have seen from the newspapers, that the long disgraceful state of this bridge has again been under the consideration of the House of Commons. The Trustees of the bridge had brought a Bill into the House at a later period of the session than is conformable to the standing orders, for "*improving* and *repairing*" the existing bridge, and the Standing Order Committee, had recommended that the usual order of proceeding should be dispensed with in its favour. Sir Robert Inglis opposed the recommendation of the Committee, on the ground that the Bill was at direct variance with the Report of a Select Committee of the House four years ago, according to which the bridge was beyond the possibility of repair, and ought to be at once and altogether removed. Mr. T. L. Hodges, one of the trustees of the bridge, assured the House that this was merely an "*enabling*" Bill — that apprehensions were entertained of "such a rapid sinking of the arches as to render the traffic over the bridge inconvenient, if not dangerous," and that all that was asked for was power to provide "a temporay passage (bridge) over the river, *while the bridge was under repair or being rebuilt*"—it not being "*yet decided*" whether "it should be repaired or

rebuilt." And so the Bill was allowed to be brought in, and read a first time. But Sir Henry Inglis not liking the complexion of the case—guessing shrewdly that there was concealed under the "enabling" pretext, a real intention of rebuilding the bridge on its present site (to which many of the Trustees are known to be inclined)—and not choosing to see the Report of the former Committee of the House so trifled with—returned, on a subsequent evening, to the charge; and moved, that the Bill should be referred to a Select Committee—which is tantamount to throwing it altogether over for the present. In this course he was supported by several other members, and ultimately the motion for a Select Committee was carried by the large majority of 138 to 15.

The public are greatly indebted to Sir Henry Inglis. There is now a certainty that the whole matter will once more undergo a thorough and impartial investigation, which we doubt not will be found to confirm to the fullest extent the statements and opinions of the former Committee on the subject. General Sir Howard Douglas (who was a member of that Committee, and took an active part in its proceedings), published afterwards, in the form of a pamphlet,* his reasons for concurring with the Committee—which was unanimous—in thinking that the bridge should be altogether abandoned; and we cannot, perhaps, do better at the present time than bring some of its more prominent paragraphs under the eyes of our readers.

The original faulty construction and present irreparable condition of the bridge are thus clearly and forcibly depicted by Sir Howard:—

"Westminster Bridge was built about the middle of the last century, under the direction of Mr. Charles Labelye. The bottom courses of the piers were laid, or built, in floating vessels, called chests or caissons, which, when so loaded, were conducted to their proper positions, and there sunk upon the natural alluvial bed of the river properly reduced to a level, after the superincumbent mud, or other matter, had been removed; the bottoms of the chests or caissons thus forming, when the sides were taken away, the platforms or foundations of the masonry, unsustained by underpiling, or any other support than that of the gravel and sand on which they rested. The serious defects and dangers of this mode of proceeding speedily appeared.* 'In the months of May and June, 1747, the western 15-foot pier of the bridge was perceived to settle very gently at first, but so much faster towards the end of July, 1747, that it was thought absolutely necessary to take off the balustrades, paving, and part of the ballast that lay over the said pier, and the two arches adjoining; but by the continuation of the settling of this pier, those arches lost their regular semicircular figure;—considerable openings in their joints showed those arches to be in some danger; and some of their stones, both in fronts and soffits, were split and broken—one of them actually fell out, and another was taken out to prevent its falling down.' Thus, before the bridge was completed, it became necessary to take down and rebuild two arches; and at different periods since, the whole of the structure has more or less settled or given way; and notwithstanding the costly works† now in progress to secure the foundations from any further subsidence, and the abstraction of some thousand tons of material from the roadway, parapets, and spandrels, Westminster Bridge has again settled, and is unquestionably in a very insecure, if not in a highly perilous state. The more remote dangers of this defective mode of laying the foundations of piers, were to a certain extent kept in abeyance so long as the river remained undisturbed, in that somewhat artificial state in which it was when the bridge was constructed. But no sooner was that condition altered; first by opening the great arch of London Bridge, then by removing the London Water-works, and ultimately by taking away old London Bridge, than all the defects of this mode of construction became very sensible, and the danger daily greater. By removing the dam which had so long obstructed the natural outfall of the river, as well as the upward passage of the tidal current, the velocity of the stream both ways has been increased, the section of the bed of the river considerably altered, while all the circumstances

* "Metropolitan Bridges and Westminster Improvements. By Sir Howard Douglas, Bart., M.P. Boone. 27 pp. 8vo. 1846."

* Labelye's Report.

† From 1810 to 1838 this bridge cost in repairs 83,097*l.* 6*s.* 9½*d.* From 1838 to 1844 the amount was 82,661*l.*, and an additional sum of 52,879*l.*, was required for further works. The property belonging to the bridge only realizes 7,464*l.* 11*s.* 8*d.* a year.

which constitute stability, have undergone, and are still undergoing, great modifications. If to the removal of the obstructions, which may be considered as the main cause of these changes, there be added the construction of the embankments, such as that which extends along the river front of the Parliamentary Palace, and the numerous wharfs which protrude into the channel, diminishing its breadth and displacing vast volumes of its waters, it will be evident that not only is the velocity of the current greatly augmented, but its direction partially changed, old passages being closed and new ones formed. The sand which used to lodge on both banks is in some places nearly all gone, leaving gravel and rubbish in its place, and at other parts pestilential mud banks appear, where formerly there had been comparatively clean and deep water."

* * *

"The attempt to secure the old foundations from further subsidence has been made by driving rows of sheet-piling into the blue clay round the old caissons, as a girdle, in order to prevent the materials of the natural bed of the river from being underwashed by the current, or squeezed out by the weight of the bridge into the gradually deepening water-courses; but notwithstanding the skill and ability with which this expedient has been devised and applied by an eminent engineer,—notwithstanding the removal of between twenty and thirty thousand tons of material from the roadway, parapets, and spandrels, and even an extension of the lengths of the piers, some of these continue to sink; and it may safely be pronounced that it is beyond the resources of science or of art to render the elongated but still defective foundations capable of bearing the weight of a new superstructure, especially with an enlarged roadway.

"To increase the width of the bridge, by additional arches laid upon the new portions of the piers, would lead to new and formidable dangers. This would, in fact, be building a new bridge, ten or twelve feet wide, by the side of the old one; and however these might be worked into each other, they never could be consolidated into one well-balanced, perfect system. Four-fifths of the width, and a corresponding portion of the weight of the bridge, would still bear upon the defective bases; and when further settlements take place, the collateral structures being at one end only of the piers, far from aiding to retain the bridge in an upright position, the firmness and stability of their foundations, not permitting them to sink with the parts to which they are attached, would cause the faces of the latter to decline from a vertical plane, and introduce cross strains, which, superadded to the other derangements, would infallibly complete the ruin of the bridge.

"The great diminution of the load taken from the spandrels, as already stated, has not prevented the progressive settlement or subsidence of the piers, while it has very materially deranged the equilibrium of the arches severally, and their mutual thrusts throughout the bridge. The removal of so much loading from the crowns, is a perilous experiment, since it exposes the voussoirs to violent shocks from the passage of carriages, often heavily laden, immediately above them, whereas the voussoirs were before protected from such concussions by the intervention of masses of material which serve to check and deaden the vibration. It may, therefore, be pronounced with the utmost certainty, that lowering the roadway down to the extrados nearly, in order to give Westminster Bridge appearances and advantages for which it was not originally designed, nor scientifically adapted to receive, must effect severely a structure which was previously in danger; and it may be added, that the great and indispensable object of a horizontal and wider carriageway can only be obtained by building a new bridge.

"An intricate analysis is required to determine the nature of the curve which the roadway over an arch should have, in order that the whole system may be duly equilibrated: the relative heights of the extrados, taken vertically at different points on the curve line of the arch, depend upon the curvature, and inversely on the cube of the sine of the inclination of the voussoir joint to a horizontal line; and therefore an arch equilibrated with a given height at the crown, is no longer so when equal depths of loading over the whole have been taken away. This is now the case with Westminster Bridge: moreover, the unequal subsidence of the piers having deranged the voussoirs and distorted the figures of the adjoining arches, the partial removal of the masses of materials which originally served to balance and strengthen them at the parts denominated "the joints of fracture," in which arches are most apt to fail, is an experiment which science forbids. A semicircular arch of voussoirs of equal weight will not stand if the centres be struck before it is properly balanced; and even with every possible care and precaution, such arches are found to settle at the crowns and rise at the hances; and there can be no doubt that the removal of so much material from the spandrels of the bridge, however this may lessen the vertical pressure on the piers,

has greatly diminished the stability of the arches.

"The bridge has sunk bodily since it was built; and in some parts as much as four feet. The seventeen-feet pier has recently settled nine inches, and is three inches out of the perpendicular. Such, in fact, have been the derangements occasioned by this settlement that it has been found necessary to reset three courses of the seventy-two feet arch, near the crown, and to introduce a new course in lieu of that which had dropped. Upon opening the spandrels of the bridge, serious cracks were discovered in the centre arch, and the arch adjoining, which actually appeared to have separated from other parts of the structure. The sinking of the piers has further loosened the arch stones on either side, and the distortion of the arches is now more obvious. The uniform surface of the soffits in some of the arches has been destroyed by the protrusion of the voussoirs, some of which have been fractured or crushed, so that parts have fallen out; and lastly, since the load was taken off from the bridge, the settlement has continued sufficiently to demonstrate that no reliance can be placed on the efficacy of that expedient."

* * * *

"The cracks at the joints of the fracture in the west spandrel of the centre, and in the east spandrel of the 68-feet arch, are the most alarming warnings that have appeared of impending danger. Since that time (1838), 135,540*l.* have been expended in attempts to prevent the damage from extending; and much it is to be regretted, that except in so far as the materials may be employed in the construction of a new bridge, the whole of that sum has been laid out in vain; for though the cracks have been filled up, the equilibrium has not been restored, and the danger proceeds: all the piers have yielded more or less; and whether the quantity or amount of settlement be great or small, it cannot be expected that the public can have any confidence in the stability of a structure so evidently insecure, and which depends entirely on expedients which have, in fact, failed, and in the efficacy of which the projector declares that his confidence is shaken. There is a point beyond which the settlement and declension of piers cannot proceed without ruin to the adjoining arches; and those which, though distorted and unbalanced, still stand upon piers that have sunk considerably, obliquely, and unequally, and which continue, up to this time, to sink, cannot be far from that point. Some of the arches have obviously lost the balanced form; and had it not been for a peculiarity in the construction of the bridge, the masonry above the voussoirs being made to radiate in the direction of the arch stones (which, however, betrays some want of confidence on the part of the architect in the stability of the bridge) those arches must have fallen."

Assuming, then, that the bridge must be taken down (to prevent its falling down), the next point to be considered is, the proper site for a new bridge. Sir Howard Douglas is for rebuilding it above the New Houses of Parliament, between Lambeth Stairs and Millbank; but as that would leave the whole of the large and important districts between the above line and Waterloo Bridge without any carriage communication, he proposes that there should at the same time be erected, near to Charing-cross, "a substantial carriage bridge, instead of the comparatively useless, and *perhaps dangerous** foot bridge which has been suspended there with so much ingenuity." His views on these points, and on other metropolitan improvements connected therewith, are eminently deserving of attention:—

"A new bridge cannot be constructed on the present site without previously removing the old one; and this would involve an expense of at least 40,000*l.* in erecting a temporary bridge, to avoid stopping altogether the communication between the Borough and Westminster, whilst the new work is proceeding. There is no room for a new bridge between the Parliamentary Palace and the present bridge, for these are already in contact; and the construction of a bridge anywhere below the present site (say from Maudslay's premises to Manchester-buildings), would occasion a very great outlay in providing new approaches. But if, leaving Westminster Bridge in its present state, as

* The Author gives, in a long note to his pamphlet, many cogent reasons for questioning the stability of this bridge, and generally, indeed, of all suspension bridges. The late frightful accident at Angers, coupled with the nearly as fatal one at Yarmouth, two or three years ago, calls loudly for that better investigation of the subject which it is now said to be undergoing at the hands of a French Government Commission. The Hungerford Bridge, it is true, stood a tolerably severe trial on the occasion of the late river procession of Prince Albert to open the Coal Exchange, and gave no signs of yielding. But the number of persons admitted on the bridge at the time was not great, and they moved about very little. Had a sudden rush been made to either end or side from any cause whatever, so as to produce a tread of the multitude isochronous with the pendulous vibration due to the system on which the bridge is built, it would, almost to a certainty, have broken down.

a temporary communication, a new bridge were constructed from Lambeth Stairs to the nearest part of the opposite bank, no expense for new approaches would be incurred, a direct communication with Westminster would be established, and a magnificent entrance into the capital formed at an interesting and venerable part. The river-face of the new Parliamentary Palace would be seen to great advantage, and, no longer disfigured and obscured on the other flank when the distasteful structure which now defaces it shall have been removed, the edifice standing gracefully and boldly out, would form a beautiful object upon the concave sinuosity of the river, extending thence to Blackfriars Bridge and Somerset House, which, for this purpose, should be reclaimed from its present unwholesome and disgusting state by the proposed embankment and terrace, which it were easy to show is an interference with the state of the river much required at that part,—and thus that pestilential locality would be transformed altogether into a beautiful and highly embellished portion of the metropolis.

"From the Westminster end of this new Lambeth Bridge, a street should be opened to lead directly to Shaftesbury-terrace, Eaton and Belgrave-squares, or to communicate with some part of that which is now being executed under the provisions of a late Act, &c.; and another formed by the river bank to Victoria Tower and Whitehall, passing between Westminster Abbey and the Parliamentary Palace.

"Entering the court-end of the town by this magnificent portal — St. Margaret's Church removed, in conformity with the unanimous recommendation of a Select Committee, from the immediate vicinity of a splendid and ample place of worship, which requires not the aid of an adjoining church, and the relics which lie around that incongruous building, exhumed — the western face of the quadrangle, by which, according to the present design, it is intended to enclose Westminster Hall, set back, to give greater space between it and Henry the Seventh's Chapel; — Parliament-street widened, by removing the block of buildings between it and King-street—Downing-street finished — and the Board of Trade completed; a majestic communication would be formed between the Regal and Parliamentary Palaces; and if Whitehall-street may not, or cannot be straightened throughout, those buildings at least should be thrown back, which, on approaching Trafalgar-square, obtrude, more immediately on the left, to destroy its symmetry.

"The several circumstances and project upon which this comprehensive proposition is based, are now before the public.—The instability of Westminster Bridge, and the necessity of constructing another; the project for building a substantial carriage bridge and viaduct at Hungerford instead of the Suspension Bridge, and for establishing a main terminus in connection with it on the Surrey side;—the objectionable project for opening a direct communication between Lambeth and Chelsea by a suspension bridge;—the embankment of the river at that part—the Bill for making a street between Buckingham Palace and the Houses of Parliament—the removal of the Halls of Court to some adjoining locality, or to a vicinity deemed more appropriate, all show that this is the time for taking these propositions into immediate and enlarged consideration, as forming together one comprehensive project.

First, let it be determined where new Westminster Bridge is to be placed. If on the present site, no credit will be done to the public taste; the beauty and effect of the new Parliamentary Palace will be spoilt, and very inadequate provision made for the public convenience. If on any other site, none appears so convenient as that which has been suggested. In this case a new street should be made by opening Wood-street and Great Peter-street, leading clear of Westminster Bridewell to Shaftesbury-terrace. A communication between the west end of Westminster Abbey and Buckingham Palace would, no doubt, be a very important improvement; but it may well lay over for a more convenient season: whenever taken in hand, it is obvious it should be executed by enlarging and improving Tothill-street and part of York-street, entering St. James's Park near the Stationary House. With respect to a communication between Buckingham Palace, the Houses of Parliament and Westminster Abbey for state occasions, or national solemnities, no more magnificent street can be formed than that which, from the Horse-guards, leads to New Palace-yard, by such a street as Parliament-street might be made when opened by the removal of the south side of Bridge-street.

"These great works may evidently be combined in a manner to accomplish, with some modifications, the intentions of their several projectors; and, at the same time, promote the general convenience of the public, while they embellish and improve the capital of this great country."

Although the Select Committee is appointed to investigate the case of the Westminster Bridge alone, they will hardly be

able to do justice to it without embracing the whole subject of the postal communications between the two sides of the river in its course through the metropolis. The propriety of any new site which may be adopted must, of course, depend on the sufficiency of the means of transit provided at other points; and there are other bridges besides Westminster which have suffered, and are still in a course of progressive dilapidation, from the late increase in the velocity of the river, consequent on the removal of Old London Bridge. We allude particularly to Blackfriars Bridge, which, though but recently repaired at a great expense, exhibits already unmistakeable signs of a serious undermining process being at work. The centre arch has sunk no less than three inches, as any person may satisfy himself by following with his eye the lines of the cornice and parapet. If means are not speedily adopted to stop this course of things, we shall, in a few years, have the ruinous story of the Westminster Bridge over again.

EFFECTS OF ATMOSPHERIC ELECTRICITY UPON THE WIRES OF THE MAGNETIC TELEGRAPH.

The *Revue Scientifique*, for December last (tom. xxxvi., p. 436), contains an interesting article by M. Baumgartner on the subject of the effects of atmospheric electricity upon the wires of the magnetic telegraph. The following are the most interesting of his results:

1. The needle rarely coincides with the point which is determined by its astatic state and the tension of its suspension thread; almost always it deviates more or less from this point; which proves that it is influenced by an electric current.

2. The variations are of two kinds; there are some which reach 50°, others extend over ⅛° or 8′. The first are less frequent; they differ so often in direction and intensity that it is impossible to deduce a law for them. On the contrary, the small deviations appear connected by a very simple law.

The observations made at Vienna, and at Gratz, appear to show that, during the day, the electric currents move from Vienna, and from Gratz, to Semmering, which is more elevated. This direction is inverse during the night. It appears that this change of direction takes place after the rising and setting of the sun.

3. The regular current is less disturbed by the irregular currents when the air is dry and the sky serene, than when the weather s rainy.

4. In general, the current is more intense with short than with very long conductors; often even the current of the longer chain is opposed to the current of the shorter chain.

Where there is a difference of intensity, this difference is far greater than that which could originate from the resistance of the longer conductor.

When the sky is cloudy, and the weather stormy, there are frequently observed in the electric conductor, currents which are sufficiently intense to affect the telegraphic indicators, which are, however, far from having extreme sensitiveness.

When they were placing the conducting wires of the Northern Telegraph line, from Vienna, the workmen frequently complained of a kind of spasms which they felt in handling the wires. These spasms ceased as soon as they took the precaution not to touch the wires with naked hands. These spasms were most frequent and intense in Styria, the highest region of the line. Thus, near Kranichfeld, a workman received a shock sufficiently violent to overturn him and paralyze his right arm.

The action of the atmospheric electricity on the telegraph is stronger on the approach of a storm, and not unfrequently the wires themselves, and the poles which support them, are destroyed by electric discharges.

M. Baumgartner cites several examples in support of what has just been said. On the 17th August, 1849, a storm which had burst forth at Ollmutz extended to Frielitz; that is to say, to a distance of ten miles. A workman employed at this latter station, in putting up the wires, experienced a shock which overturned him, and he experienced a real burn of the fingers which touched the wire. At this time the sky was perfectly serene at Frielitz.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JULY 5TH, 1850.

WILLIAM PALMER, Sutton-street, Clerkenwell, Middlesex, manufacturer. *For improvements in the manufacture of candles, lamps, and wicks.* Patent dated June 29, 1850.

This invention relates; firstly, to the manufacture of candles; secondly, to the manufacture of candle lamps; and thirdly, to the manufacture of candle wicks.

1. The patentee employs rosin or some other resinous matter mixed with tallow,

or non-acidified candle stuff, and uses one, two, or more wicks, which have the property of turning out of the flame while burning, so as to avoid the necessity of snuffing, and thereby render candles, composed of such materials, capable of being burned in candle lamps. He states, that he is aware that candles composed of rosin, or some resinous substance and tallow, have been made, but with ordinary wicks, which, in consequence of their requiring to be constantly snuffed, necessitated their being burned out of a lamp, like ordinary candles. The result of this mode of burning caused them to produce a gerat quantity of smoke, which rendered their use very objectionable. The mode of preparing the materials is as follows:—1 part by weight of rosin, or other resinous substance, is mixed with 8 parts by weight of hard tallow, or non-acidified candle stuff, and (by preference) 1 part by weight, of vegetable wax. To 1 cwt. of this mixture is then added 3 lbs. of American potash in solution, and 5 lbs. of vitriolic acid; after which the whole is boiled for five minutes, and subsequently washed with warm water.

2. Instead of making the parts of a candle lamp,—that is to say, the nozzle, the stem and the foot, as heretofore of brass, or tinned iron, which are comparatively expensive metals—Mr. Palmer makes them out of sheet iron; for which purpose the nozzle and foot are stamped out of sheet iron, and the stem is composed of a tube of the same material; the whole are to be soldered or brazed together.

3. The various improvements in the manufacture of candle wicks are,—1. An improvement in the machine, patented June 9, 1849, for coating candle wicks with tallow and keeping them separate, which consists in making the tube (containing the tallow), and the nozzle, &c., in several pieces, which are connected together by screws, so that the nozzle may be removed when required without causing the rest to revolve. 2. Making rush-lights in such manner that the rushes shall turn out of the flame. For this purpose the whole of the exterior is peeled off, except on one side, instead of on two opposite sides, as has hitherto been customary, and the necessary preponderance on one side is thus obtained; or the whole of the exterior may be peeled off and the preponderance given to one side by coating it with bismuth or charcoal, mixed with paste to the consistency of paint. 3. Giving the preponderance to one side of cotton cord wicks, necessary to cause them to turn out of the flame when burning, by attaching to them or gymping them with a strip of jean, cartoon, or other hard fabric, or by coating it on one side with the mixture before mentioned. 4. Making wicks out of a fabric cut into strips, which has been previously coated, while stretched, with the mixture before mentioned. 5. Making wicks out of strips of velveteen, or other similar fabric having one surface softer than the other, whereby the necessary inclination to turn out of the flame will be given to them. 6. To avoid the want of uniformity of resistance of the gymping thread, arising from the diminishing size of the reel as the work proceeds, Mr. Palmer proposes to wind it like a cop on a stem, the other end of which is attached to a rigger, which surrounds the tube through which the wick passes. 7. Saturating the wick before gymping with tallow: they are subsequently passed through an eye to remove the superfluous tallow. Flat wicks are rounded, after saturation, by passing them when cold through an eye. 8. Cutting fabrics into strips, to form wicks by means of a knife, which is forced through or drawn across them against a straight edge, that retains them in position during the operation. The machinery for working the cutter, the straight edge and the feeding-in table, are of the ordinary construction, and worked by hand. 9. An improvement in the wick-holders, which was the subject of a patent granted to the same gentleman, June 9, 1849. It consists in the addition of inclined tubular wick-holders to the sockets.

Claims.—1. The manufacture of candles, suitable for candle lamps, by combining tallow, or non-acidified candle stuff and rosin, or some resinous substance with one, two, or more wicks, which have the property of turning out of the flame when burning.

2. Making the parts of candle lamps of sheet iron.

3. The several peculiar modes of making candle wicks.

William Barlow, Blackheath, C.E., and William Henry Barlow, Derby, C.E., *for improvements in the permanent ways of railways.* Patent dated January 3, 1850.

The patentees describe and claim—

1. Casting the bearers of that part of the permanent way where there are switches or crossings with two or more chairs.

2. Supporting the lines of rails by means of transverse and longitudinal bearers combined, having two or more chairs cast thereon.

3. Riveting trough - rails to bearers, which are connected by transverse pieces to maintain the gauge.

4. Constructing railway turn-tables, which are supported at the centre by a screwed pin, and of iron plates riveted together, and to

a number of T pieces of iron arranged radially around the centre, and within an iron ring, which is furnished on the underside with rollers.

JOB SIDEBOTTOM, Pendlebury, Lancaster, manager, *for certain improvements in steam engines.* Patent dated January 3, 1850.

This invention consists in connecting a system of levers and adjustable gearing to the governor and to the throttle valve and air-pump of a steam engine, in order that when it shall have attained an undue velocity, its further motion will be arrested by the closing wholly or partially of the valve, and by the admission of air into the condenser; also, in an arrangement of apparatus whereby the increased velocity of the governor shall cause a bell to ring, for the purpose of indicating this circumstance to the engineer.

THOMAS LIGHTFOOT, Broad Oak, Accrington, Lancaster, chemist, *for improvements in printing and dyeing fabrics of cotton and other fibrous materials.* Patent dated January 3, 1850.

1. The fabrics are to be partially bleached, by boiling from five to seven hours in water, with 2 oz. crystallized carbonate to each pound of fibre. It is next washed, dried, and steeped in sulphuric acid mixed with water of a strength of 1° Twaddel's hydrometer, then washed and dried again, after which the fibres are immersed in a mixture consisting of ½ oz. of pearlash, 1½ pints of water at a temperature of 110° Fahr., and 2 oz. of olive oil (to each 1 lb. of fibre), until absorption takes place. They are subsequently dried in a stove, and subjected twice to the first operation, and dried again. They are then made to absorb clean water at 110° Fahr., to the extent of 1½ pints for each 1 lb. of fibre. These two operations (absorption and drying) are each repeated alternately eight times, after which the fibres are steeped or padded in a solution of 1½ ozs. of pearlash to 4 pints of water, dried and saturated with acetate of alumina. This mordant is fixed by washing; after which the fibres are ready to receive the colour. Instead of the preceding process, the patentee states that the same result may be obtained by saturating the fibres with a solution of any of the metallic bases, such as salts of magnesia, tin, copper, nickel, or cobalt; or with a solution of an alkali, or an alkaline solution of a metallic oxide, such as aluminated soda, or aluminated potash, oxide of tin, in a solution of lime, soda, or potash, &c. The orchil or cudbear is prepared for printing by mixing it with gum-senegal, and is applied to the fabric, and subsequently steamed in the usual manner. The fabric, when composed of vegetable fibres entirely, may be subjected, after it is woven, to the preparatory process; but if composed of vegetable and animal colours combined, the vegetable fibres must be prepared by themselves previously to weaving them with the others. If orchil or cudbear alone is used, then the colour is brightened by passing the fabric through an alkaline solution; but if other colours are used, which would be injured by the alkali, then those portions of the fabric on which the orchil or cudbear has been printed are printed over with an alkaline solution, thickened to the required consistency. Or 24 oz. of hydrate of magnesia, or 12 oz. of calcined magnesia may be mixed with 1 gallon of colour before printing.

2. The improvement in dyeing vegetable fibres consists in preparing them by either of the processes before described, and dyeing them with orchil or cudbear, in the same manner as wool or silk has hitherto been dyed with the same colour.

Claims.—1. Printing orchil or cudbear on to fabrics composed wholly or partially of cotton, linen, or other vegetable fibres, prepared in the manner before described, and also the use of magnesia combined with orchil or cud-bear.

2. Dyeing vegetable fibres, prepared, as described, with orchil or cudbear.

ALEXANDER BRODIE COCHRANE, Jun., and ARCHIBALD SLATE, Dudley, Worcester, engineer. *For improvements in the manufacture of iron pipes or tubes.* Patent dated January 3, 1850.

The patentees describe and claim—

1. A mode of guiding the internal pattern of moulds by affixing it to the top of a rod, which slides in a guide plate on the top of a tube, and carries a piston at bottom, whereby any oscillation or unsteadiness of motion of the internal pattern as it is successively lifted up is prevented.

2. A method of ramming in the sand, by causing the ramming-in tube to inclose the guide rod, and communicating to it (the ramming-in tube) a reciprocating and slow rotary motion by the intervention of toothed gearing from any suitable prime mover.

3. Drying moulds, by placing above the pit in which they are contained a furnace and blowing-apparatus, and within each mould a vertical cylinder, communicating at bottom with the interior and exterior of the mould, through which hot air is driven.

4. Removing the products from retorts or ovens in which cores have been dried, by means of pumps, fans, or other mechanical means.

5. Coating cast iron pipes with glass by covering the sides of the core with a composition which will melt by the heat of the molten metal. For this purpose it is proposed to grind up together 130 parts flint glass, 20 parts soda, and 12 parts boracic.

This mixture may be either applied in a dry state to the core, by previously coating the latter with a gumming solution and dusting the powder over, or it may be brushed over the surface in a moist state.

6. A machine for bending up the skelp in the manufacture of wrought iron tubes, which consists of a suitable framework carrying at bottom a main driving shaft with two cranks, placed in the same direction, which communicate an alternately raising and falling motion to a bed plate. Upon this bed plate is fixed the bottom or moveable die, which, at the entrance end, is of an open gutter shape, gradually diminishing in size towards the opposite or exit end until it assumes the appearance of a semicircle. The top die is fixed and made to correspond to the lower one. In front of the machine, where the lower die is widest, there is mounted a pair of feeding-in rollers, which, at each fall of the bed plate, is caused to make a partial revolution by means of a ratchet wheel keyed on the axle of one of them, in which acts a paul in connection with one of the cranks. This intermittent motion, or partial revolution of the feeding-in rollers, is communicated to a pair of finishing rollers, which are mounted in the other end of the framework, opposite the contact end of the lever die. These rollers are grooved so that the space between them forms a complete circle. The skelp is introduced by the feeding-in rollers between the dies, and as it is successively pushed forward it is gradually bent up until it is delivered to the finishing rollers, which complete the operation.

Albert Crackell Waterlow, London-wall, lithographer, *for improvements in the means and apparatus for obtaining copies of writings, drawings, and other designs.* (A communication.) Patent dated January 3, 1850.

The improvements sought to be secured under this patent are—

1. A peculiar construction of lithographic press, in which the presser roller is made to travel over the stone with the paper interposed.

2. A portable copying press, which consists of a suitable support, on which the autography paper is laid, above that the paper, and over the last another piece of paper, which is maintained in position by pins or otherwise, while pressure is applied by a roller or straight edge.

No claims are made in this specification.

Henry Dorning, Hearsley, Bolton, Lancaster, brick and tile manufacturer. *For certain improvements in machinery or apparatus for manufacturing bricks, tiles, and other similar articles from clay or other plastic materials.* Patent dated Jan. 3, 1850.

The patentee describes and claims—

1. The application to the front of a pug mill, but eccentric to it of a revolving table, with recesses or hollows therein, which successively receives the bricks as they are moulded, and carries them round to be lifted out of position by hand or machinery, and removed.

2. Working the two pistons of a pug mill by rods connected to cranks keyed opposite to one another on either side of a worm cut on a horizontal shaft. A toothed wheel keyed on the driving shaft gears into the worm, and communicates motion to the pistons, one of which advances while the other recedes, so that a continuous stream of clay is forced through the mill.

3. Compressing and solidifying the clay, after it has been formed into the desired shapes, by means of pistons acting in moulds, which are worked by a machine similar to the one last described.

4. Two modifications of the preceding machine, in which the pistons and moulds are worked by cams and levers.

John Read, Park-terrace, King's-road, Chelsea, gentleman. *For improvements in extracting fluids from animal, vegetable, and mineral substances, and in compressing the same.* Patent dated June 29, 1850.

The machine which forms the subject of this patent consists of two perforated horizontal cylinders, termed "extracting boxes," open at both ends, which are placed one in front and the other behind a horizontal steam cylinder. The piston rod passes through the piston and through stuffing boxes in the front and back covers of the steam cylinder. Each end of the piston rod is fitted with a "ram," which works to and fro in its respective extracting box. The rams are made hollow, and with the fore ends perforated to allow of the passage of the extracted fluid. The outlets of the "extracting boxes" are provided with perforated hollow "end plates," which may be locked and made to bear against these openings, so as to offer resistance to the compression of the substances while under operation, or may be moved away from them to allow of the exit of the compressed substances. The movement of the end plates is effected by two systems of levers. The perforations in the rams, end plates, and the extracting boxes are covered with some suitable fabric for the purpose of filtering the fluids that are expressed, and which escape through channels provided for that purpose into a suitable receptacle. Each of the extracting boxes is provided with a hopper, placed on the end near the steam cylinder, for feeding in the substances to be compressed.

Claims.—1. The employment of the extracting boxes, rams, and end plates, com-

bined into a machine for extracting fluids from animal, vegetable, and mineral substances, and for compressing the same.

2. The application of steam direct to the extraction of fluids and compression of substances.

Specification Due, but not Enrolled.

Louis Cesaires Charpillon, Rue de Luxembourg, France. *For improvements in locks for guns and pistols.* Patent dated December 29, 1849.

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal.*)

For an Improvement in Apparatus for Distilling Sea-water. *John Ericsson and R. B. Forbes.*

The patentees say,—"Our invention consists of a boiler, to be worked at very low pressure, with horizontal flue-tubes so situated, relatively to the door for supplying the fuel to the grate, that the opening of this door will expose the flue tubes to view, and admit of cleaning out the soot that unavoidably collects in, and which would otherwise choke them.

"Also, in connecting the steam chamber of the said boiler with the upper end of a condenser, by a flexible pipe attached to a bonnet or dome, which rests on and closes a large aperture at the top of the boiler, in the manner of a safety valve, that it may answer the manifold purposes of steam pipe connection, safety valve, steam dome or chamber, hand hole, for giving access to the inside of the boiler, and for ascertaining by inspection the height of water in the boiler.

"Also, in condensing the steam, by causing it to pass between two vessels, the inner one kept cool by the flow of water through it, and the other by the evaporating action of the atmosphere on moist cloth or other porous substance surrounding it, that the required condensation may be effectively attained in very warm climates.

"Also, in employing, in combination with the boiler and the condenser, a water feed pipe having a double connection, one with the boiler and the other with the condenser, whereby the same feed pipe supplies the boiler and condenser.

"And finally, in combining with the boiler and the feed pipe a feed cistern with a cork or other light float, which, when the water is at the required height in the boiler, will be forced up close to the aperture of the feed pipe, and thus cut off the supply.

Claim.—"What we claim as our invention in the before described apparatus for the distillation or production of fresh water on board of ships or other vessels, is connecting the steam boiler with the condenser by means of a flexible pipe, substantially as described, in combination with the valve-joint connection of the bonnet or steam dome covering the hand hole in the top of the boiler, substantially as described, whereby this connection is rendered of manifold uses, as described.

"We also claim condensing the steam by passing it in a space between two vessels, the inner one kept cool by a current of water, and the external one surrounded by woollen or other porous substance to be kept in a moist state, to condense the steam by the evaporating effect of the atmosphere on the moistened surface surrounding the outer case, substantially as described, whereby the apparatus is especially adapted to very low latitudes, as described.

"And finally, we claim the feed pipe for supplying water to the condenser, and for feeding the boiler, substantially as described, in combination with the cistern that conducts the feed water to the boiler, and provided with a float for regulating the flow of water from the feed pipe, substantially as described, whereby the apparatus is rendered self-feeding without liability of derangement, as described."

For an Improved Means for Working Sails. *William A. Ross.*

The patentee says,—"My improvement in, or addition to, the parts employed about the foresails of sloops or schooners, or the jibs of these or other vessels, or any other fore-and-aft sail, when the foot of the sail is stretched flat or straight by a boom, consists in the addition of a rope, so fitted that it prevents the sail from sticking or stretching, so as to tear at the diagonal line or point of shortest distance between the after end of the boom and the bolt rope of the sail, thereby facilitating the furling or stowing of the sail when lowered, and aiding in setting the sail when hoisted.

Claim.—"I claim as my invention, the attachment of a rope to the bolt rope of a sail, to act as a downhaul in lowering, and to sheet the sail home when hoisting, such rope passing by sheaves or blocks, or in any convenient manner, from one end of the boom to the other, so that it operates to release the cringle, and relieve the sail when lowering, and replace the cringle, and sheet home to the sail when hoisting, substantially as described.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Lancaster, of New Bond-street, Middlesex, gunmaker, for improvements in the manufacture of fire arms and cannon, and of percussion tubes. July 3; six months.

John Coope Haddan, of Bloomsbury-square, in

the county of Middlesex, civil engineer, for improvements in the construction of carriages and of wheels, and in brickwork. July 3; six months.

Francis Edward Colegrave, of Brighton, Esq., for improvements in the valves of steam and other engines in causing the driving wheels of locomotive engines to bite the rails, and also in supplying water to steam boilers. July 3; six months.

Charles Phillips, of the city of Bristol, engineer, for improvements in apparatus or machinery for cutting turnips and other similar substances as food for cattle. July 3; six months.

Richard Hornsby, of Spittlegate Grantham, in the county of Lincoln, agricultural implement manufacturer, for improvements in machinery for sowing corn and seeds, and in depositing manure in thrashing machines, in machines for depositing or winnowing corn, and in steam engines and boilers for agricultural purposes. July 3; six months.

James Thomson, of Glasgow, civil engineer, for improvements in hydraulic machinery, and in steam engines. July 3; six months.

Richard Winter, of New Cross, in the county of Kent, gentleman, for improvements in metallic vessels for measuring and holding liquids. July 3; six months.

James Ward Hoby, of Blackheath, engineer, for certain improvements in the construction of parts of the permanent ways of railways and in shaping iron. July 3; six months.

Paul Rapsey Hodge, civil and mechanical engineer, of Adam-street, Adelphi, for improvements in certain descriptions of steam engines, and in the apparatus and management for cultivating and manuring the soil, and in treating the produce thereof. July 3; six months. (Partly a communication.)

Wakefield Pim, of the town or borough of Kingston-upon-Hull, engine and boiler maker, for certain improvements in the construction of the boilers and funnels of steam engines. July 3; six months.

Charles Starr, of New York, in the United States of America, for improvements in bookbinding. July 3.

James Kingsford, of Essex-street, Strand, Esq., for improvements in refrigerating and freezing. July 3; six months.

Weston Tuxford, of Boston, in the county of Lincoln, for improvements in machinery for crushing or pressing land, and for shaking straw; also improvements in applying steam power to agricultural machinery. July 4; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
June 26	2353	Stephen Sharp	Stamford	Lump-sugar cutting machine.
,,	2354	Webb and Greenway	Birmingham	Cupboard fastener.
27	2355	James & George Johnston	Paisley	Cutting apparatus for bonnet tops.
28	2356	Hopwood and Armstrong	St. George-street, Wellclose-square	A door and apparatus for closing the opening of ships' scuttles.
29	2357	Anthony Ettrick	Highbarne, Sunderland	Travelling bag or portmanteau.
July 1	2358	Charles Cowper	Southampton-buildings, Chancery-lane	An addition to a braiding machine.
,,	2359	Henry Alfred Jowett	Sawley, Derby	Parts of a signal lamp.
2	2360	James Woods	Stow Market, Suffolk	Bruising and grinding mill.
3	2361	George Simpson	Spurrier-gate, York	The York coat or paletot.
4	2362	William Walker	Manchester	Ventilating chimney tube.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1405.] SATURDAY, JULY 13, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

FERGUSON'S IMPROVED GUN-CARRIAGE.

Fig. 1.

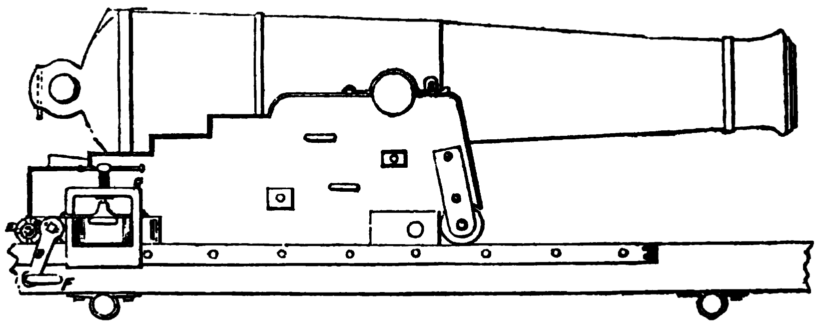


Fig. 3.

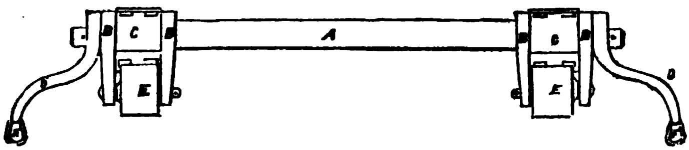


Fig. 4.

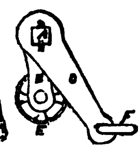


Fig. 2.

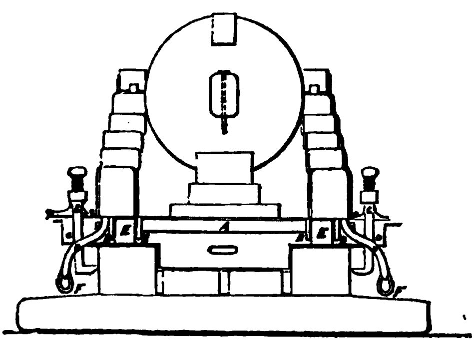


Fig. 5.

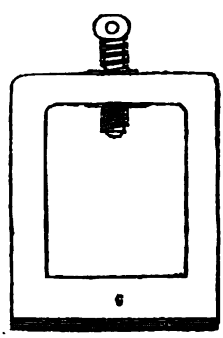


Fig. 6.

FERGUSON'S IMPROVED GUN-CARRIAGE.

(Registered under the Act for the Protection of Articles of Utility. Messrs. C. A. and T. Ferguson, Mast-house, Mill-wall, Proprietors.)

SIR,—Great would have been the gratification of the late Brigadier-General Sir Samuel Bentham, could he but have witnessed the almost daily realization that takes place of many of the ingenious plans which he propounded, or the requirements which he called for, both in civil and military engineering. The *Mechanics' Magazine* for June 15 (vol. lii., page 468), contains the general's statement of the properties that should characterize a good *gun carriage*: viz., that when it is required to train the gun forward "the weight of the gun and carriage shall be transferred instantaneously from the broad bearing on which it rests, on to rollers, so placed as that it shall be easily trained forward or aft, and that, on letting go the handspike, the effect of the rollers shall instantly cease, and the gun remain steadily fixed by its own weight in the position to which it has been brought." By a somewhat remarkable coincidence, the very same number of your Magazine, announces the *registration* by Messrs. C. A. and F. Ferguson, of an improved gun-carriage possessing all the advantages contemplated by Sir Samuel Bentham. Since the time at which he penned his varied "notes," the general and extensive employment of heavy guns on slide carriages has convinced most persons conversant with the practice of naval gunnery, of the serious deficiencies of the system hitherto in use, and the urgent necessity for some practical improvement to facilitate the working of these tremendous pieces of ordnance with greater ease and safety. The improved gun-carriage of Messrs. Ferguson seems to supply every deficiency—to meet every possible requirement.

Fig. 1 is a side elevation, and fig. 2 a rear-end view of a 68-pounder gun, 10 feet long and weighing 95 cwt., mounted upon Messrs. Ferguson's improved carriage; fig. 3 shows the lifting apparatus detached, and fig. 4, an end view of the same; fig. 5 is a front, and fig. 6 an edge view of their improved compressor. A is a strong shaft or spindle passing through kneed gudgeons C, attached to the lower edges of the brackets and the after edge of the rear-block, uniting them strongly together. BB are links affixed to the shaft A, and having between them rollers E. At the outer ends of the shaft A are levers D, furnished with ring links F, to receive the hooks of the gun-tackles. In figs. 1 and 2, the gun-carriage is shown as resting upon the slide; but on attaching the gun-tackles to the links F, and drawing the levers D forward (into the position shown by figs. 3 and 4), the rear end of the carriage and both friction blocks are lifted off the slide and the carriage supported upon the four rollers, fore and aft; on continuing to pull the gun-tackles, the gun is trained forward with great facility. The shaft A working in the gudgeons C, as a fulcrum, forms simultaneously a leverage and propelling action, so direct, that in working the heaviest guns it is all that could be desired. Both rollers being affixed to the shaft A, and working together, ensures simultaneous action, and maintains a true bearing on the slide which adds greatly to its stability,—a most important point, especially in a sea way. At the same time it provides an effectual remedy for any irregularity of the men when "rousing out" the gun, and also provides against the contingency of accidents to the tackles, as should one be injured or shot away, the working of the gun will not be much impeded, until such time as it can be replaced. The compressers G (shown detached in figs. 5 and 6) are a vast improvement over those hitherto employed; they are made with the iron placed edgewise, and are therefore stronger with less weight of metal than those in common use; being more economical in manufacture, and greatly superior in use. Having no ribs or other projections, Messrs. Ferguson's compressors do not interfere with the working of the gun-tackles which pass them freely; their use also, permits some three or four inches to be saved in the length of the rear blocks of the gun-carriage. These improvements of Messrs. Ferguson's, are generally considered the most important that have been made in this department, since the first introduction of slide gun-carriages, and will no doubt come rapidly into use in this highly important branch of marine artillery. I remain, Sir, yours respectfully,

WILLIAM BADDELEY.

29, Alfred-street, Islington, June 25, 1830.

The same vessels having at some times been considered the best sailing vessels in the Navy, at other times the worst, Sir Samuel Bentham took some pains to ascertain how such a difference in the estimation of their properties had arisen, and found that it was most frequently consequent on their more or less immersion in the water. At the present day, too, it often happens that the sailing qualities of a ship are at one time highly vaunted, at another as much disparaged. Sir Samuel thought that examples taken from former ships were, on account of the absence of preference or prejudice in regard to them, the most useful; the following abstracts from information he collected may, therefore, without reference to vessels of the present day, show how greatly the sailing of a ship depends on the degree of her immersion.

The *London*, in the last century, sailed so well on the American station, that it was universally thought no 90-gun ship should thereafter be built that was not like the *London;* accordingly the *Prince*, the *Impregnable*, and the *Windsor Castle* were built from her draught. This very *London* was paid off in 1794, as the *worst sailing ship in the fleet*. At the time the *London* sailed so well, she was *light;* when so miserably ill, *very deep*.

The *Prince* and the *Impregnable* always sailed ill; they were *always deep*.

The *Triumph* and the *Valiant* were built from the draught of the French *Invincible*. The *Valiant*, at first going to sea, sailed rather in a superior style—the *Triumph* sailed very ill—the cry was that she differed from the *Valiant*, and that was the cause of her bad sailing; "she had been measured and found to be no less than three inches broader than the *Valiant*, and that great difference accounted for the bad sailing of the *Triumph*." But the *Triumph*, afterwards on the American station, sailed better than every other ship, and the *Valiant*, in 1790, was one of the worst sailing ships in Lord Howe's fleet. The *Triumph* when she sailed ill was deep, when she sailed so well was *light*. The *Valiant* when she sailed ill was *deep*.

The *Canada* sailed so well that the *Majestic*, *Captain*, and *Orion* were built from her draught. In going down Channel, on her way to the West Indies, the *Orion*, with a fresh easterly wind, went only 8 knots; she had at least six times as much sail set as some of the other 74-gun ships, yet she with difficulty kept way with them; her ports were then 4 feet 10 inches out of water. At Barbadoes, as much ballast and other weight was taken out of her as amounted to 120 tons; and on the passage home her casks were not filled with salt water, so that when she arrived in England her ports were 6 feet 4 inches out of water, at which time, with studding sails set, she went 13 knots. Her difference in rate of sailing, with equal strength of wind and equal quantity of sail, but more or less immersed, was

8 knots *deep*, her ports being only 4 feet 10 inches out of water.

13 knots *light*, her ports being 6 feet 4 inches out of water.

The second time the *Orion* went to the West Indies, her ports were 5 feet 2 inches out of water; she went into the *Chesapeak* to complete her water; the pilot that carried her in said his boat would certainly beat the ship—(the Virginia pilot boats were noted for sailing well)—particularly as it was smooth water and the wind a-beam. The boat was then going 7 or 8 knots; the ship 10 knots, though she was towing all her boats, and on that account her main-sail was not set.—The pilot was amazed; but was told that on going out again his boat would beat the ship. Accordingly, in going out, the same boat passed the ship—the pilot was still more amazed, for his boat was in the same state as before, and he could see no alteration in the ship; but the ship in going in was light, when coming out 7 inches deeper in the water.

The same ship, the *Orion*, when in Lord Howe's fleet, in 1790, was one of the worst sailing vessels, and not weatherly; she was then deep. In Lord Hood's fleet, in 1792, she was looked at with astonishment; she beat everything, brigs, cutters, frigates, ships of the line, in a most wonderful degree; she was then light.

The *Canada* when she sailed so well as to have been a model ship was light; she was deep when, in company with the *Alexander*, that ship was taken, and the *Canada* was in danger of being so also, when the captain was advised to lighten

her; he did so, and the effect was immediate—she sailed faster, and so escaped.

One of the ships above mentioned, the *Prince*, having always been deep, and having always sailed ill, instead of trying the effect of lightening her, was made the subject of a very costly experiment, that of cutting her across in midships, and lengthening her 17 feet, the addition being between her two halves. It was difficult to conceive what the object of this experiment was, since there were other 90-gun ships in the service of the same proportion of length to breadth that was given to the *Prince* when lengthened, nor was any reason for the alteration stated in any official document, other than that she was a bad sailor; but whatever might have been the point to be ascertained by her elongation, it would have been essential that the ship in other respects should have been in the same state as before the lengthening her; on the contrary, at the same time that this alteration was made, a considerable addition was given to the breadth of her rudder, and also to the depth of her false keel. After she went to sea again, the officer, who had to report on her qualities, expressed his uncertainty as to which of the alterations her improvement was to be attributed to, but spoke of it as having arisen principally from her being now less immersed in the water than she had been before the alteration.

Sir Samuel brought officially to the notice of the Admiralty the uselessness of that experiment, seeing that it was not confined to one particular object.—The same disregard to confining experiments to a single object still remains—still nullifies almost all that relate to the qualities of navigable vessels. It is true that when the rate of a Government steamer has to be ascertained, she is often tried with her full lading on board, or with other equivalent weights; but the simple experiment of trying the different rates of progress of the same vessel, when immersed to different depths seems as yet to have been altogether neglected. The most advantageous depth of a vessel for locomotion is, however, of great importance for private traders as well as for vessels of war, since on that circumstance materially depends the propriety of giving requisite bulk to a vessel by her depth, or by her length.

M. S. B.

THOUGHTS ON MATTER,—BEING THE SUBSTANCE OF A LECTURE DELIVERED TO THE DUNSTER MUTUAL IMPROVEMENT SOCIETY. BY MR. W. SYMONS.

Almost every person understands what is meant by the word "Matter," and yet it seems impossible to give a satisfactory definition of the term; and the study of the nature and constitution of matter is a subject in which the ablest philosophers lose their depth. Although it is so palpable to the senses of the most ignorant, yet the studious and learned are soon lost in metaphysical uncertainties, and can only indulge in shrewd guesses, or are constrained to say—"We do not know," in answer to many questions connected with matter.

Matter has been defined as "everything we see," as "that which occupies space and resists force," and again, as "that which is the object of our senses." I have searched for a more satisfactory definition of the term, but I have not been able to find one: perhaps as good a one as either of the above would be—"Everything."

Matter makes itself known to us by the following properties:—*Extension*, *Figure*, *Impenetrability*, *Divisibility*, *Inertia*, and *Attraction*. These are called essential properties, as belonging to all kinds of matter at all times.

Extension may be otherwise expressed—as size, bulk, magnitude; and it means the quality of occupying a certain portion of space. Figure is synonymous with form, shape, &c., and decides the amount of extension. It is well for us to endeavour to conceive of these two qualities abstracted from and independent of the matter with which we generally find them associated, and it is in this manner they belong to geometrical figures.

Impenetrability, or *solidity*, means that no two portions of matter can occupy the same space at the same time. Although this has always been called an essential property, and perhaps cannot be denied with regard to matter in bulk, it has been questioned whether it be a property of the ultimate atoms, as we shall see more fully soon. This quality must not be confounded with *hardness*. The air is as impenetrable and as solid as that wall, although I can push my hand readily through the air, and cannot make the least impression with it on the wall; the reason of this is, the particles

of the air move readily out of the way, while the particles of which the wall is composed are kept together by the property of hardness, which may be defined to be the power that keeps the particles of certain bodies from being readily and easily removed or separated into parts. I need not refer to some apparent contradictions of this property, such as driving nails into timber, &c., as the reason of such instances of penetration must be evident to every observant mind, as arising from the removal of certain particles to make room for others; but I am inclined to believe that the reasonings of a living philosopher have thrown doubts on such an explanation being receivable in all instances.

The next property is *divisibility;* that is, the capability of being divided. Experience proves that matter possesses this property to an inconceivable extent. I would not say to an *infinite* degree, for this is improbable, if not impossible; for no number, however great, of infinitely small atoms, could occupy a sensible portion of space. There is a vast difference between inconceivably and infinitely small. There are many familiar and interesting illustrations of this quality, such as the thickness of the water composing a soap bubble, which has been stated not to exceed the two million five hundred thousandth of an inch—a fraction easier expressed than conceived. (Two million five hundred thousand inches would be nearly forty miles.) You can dissolve sulphate of baryta in a million times its weight of water, and can then perceptibly detect its presence by chemical means in the smallest drop of the water. Other instances may be referred to, but these are deemed sufficient; but it is a quality that I wish to impress on your minds, as we shall have to refer to it again.

Inertia literally means *inactivity;* it signifies the tendency of matter to continue either in a state of motion or of rest; it renders fly-wheels of service in machinery, makes cannon-balls so destructive, enables little boys to slide on the ice, and is the cause of the dreadful railway accidents we sometimes read of. It has been suggested by Grove, that inertia is a consequence of the attraction of gravitation, which is another general property of matter, and was the great discovery of the illustrious Newton—on which discovery hinges the whole science of astronomy; it means the mutual attraction which all masses of matter, however large or small, have for each other. It is the cause of the weight of bodies, which is the amount of attraction that every material object has to the centre of the earth.

The other kinds of attraction are—*cohesion*, which is the power that holds particles together so as to form massses, a power which varies considerably in different kinds and conditions of matter, and, as before stated, is the cause of hardness, tenacity, &c.: *chemical attraction*, or affinity, which is the attraction of dissimilar portions of matter, and may be illustrated by a glass of soda-water, the effervescence of which is caused by the attraction or affinity being greater between tartaric acid and soda than between carbonic acid and soda. Attraction, in some one or other of its shapes, is the cause of all the ever-changing but perpetual phenomena of the material world.

Thus I have, in an imperfect manner, referred to the general properties of matter; and it is only as a repository of these properties or qualities that we know of its existence. At the commencement I stated that matter may be described as "everything;" but there are some persons who assert that everything is nothing, and it seems difficult to prove the contrary. Some of the ancients considered matter as eternal; but they had not the light of Divine revelation. We may imitate that sublime passage in Genesis, where light is brought before us for the first time, and describe the creation of matter in the same concise terms—"God said let there be matter, and matter was;" it sprang into existence out of nothing, at the Almighty word; and what is it but the embodiment of the Divine thought? It owes its character for stability to the omnipotence and constancy of its Creator; and when he originated the material universe, he gave to each minute particle its distinctive and individual, as well as its universal and general properties; these it has kept entire and unchanged through all its numberless vicissitudes.

It would be impossible to bring before you Bishop Berkeley's theory in a manner to make it plain; it requires to be read and re-read, and thought about and read again, to get a glimpse of his meaning: and I think I am warranted in saying, it would be a task worthy of the

deepest thinker and greatest student in existence, to explain it in a popular lecture, so as to be understood by persons who have not made it the object of previous study. His theory is founded on the assertion, that we have no proof of the existence of matter but in our own perceptions; his own words are—"All the choir of heaven and furniture of the earth have not any subsistence without a mind; their being is to be perceived or known; consequently, so long as they are not actually perceived by me, or do not exist in the mind of any created spirit, they must either have no existence at all, or else subsist in the mind of some eternal spirit." A writer on Berkeley says—"You admit that your existence and your power of perceiving, as well as the perceptions by which the second makes you know the first, are ultimately to be traced to the will of the Creator. You cannot figure to yourself the uniform nature of the perceptions which you receive as coming directly from the Creator, but you suppose a power of imparting them to be made inherent in a certain substratum which you call matter. But if you admit that it is in the power of the Creator to furnish you directly with those ideas of space, figure, &c., which to you constitute the material world, without any intervention of which you can form a positive conception, how do you know that he has not done so? The answer must be, that there is no such knowledge; and this is the point on which Berkeley has never been, and, it is not too bold an assertion to say, never can be refuted." In another place it is said—"The system of Berkeley is briefly this: matter does not exist independently of our sensations, but conceptions of a material world are produced by the operation of the Deity upon our understanding, and the material world exists only in the Divine intellect, who awakens in us certain sensuous conceptions in a definite order, which order is what we call the course of nature."

Dr. Johnson said he refuted Berkeley by stamping his foot; but he only demonstrated that he had not comprehended Berkeley's meaning; for stamping one's foot only illustrates the solidity of matter, which is one of its properties, or one of our modes of perception.

The general notion of the ultimate atoms of matter appears to be that of inconceivably small particles with a defined and permanent shape, and perhaps most persons have the idea that these atoms are round; others suppose that various kinds of matter have different shapes; thus, one may be triangular, another square, and a third round. It is a necessary consequence of this theory to suppose that generally, if not always, these atoms do not touch each other, but have intervening spaces between them, otherwise cold, or pressure would not cause matter to contract, nor heat, on the removal of pressure, cause it to expand, which experience proves is the case. In the liquid form these atoms are free to move about each other, and in gases and vapours they must be at a considerably greater distance from each other, and yet there must be a mutual dependence and relation; but, if this theory be correct, the greater part of every gas consists of space. In the state of gas, oxygen occupies about 2,000 times more space than it does in a state of solid combination. I would remind you that the particles we are now talking of must be inconceivably minute; probably so small that, could we imagine the smallest animalculæ possessing sufficient intelligence to construct a microscope adapted to their tiny organs, it is probable they would not then attain the sight of an atom of matter.

Faraday has attacked this doctrine, and he defines matter as "Consisting of centres of forces surrounded with atmospheres of power; or having powers attached in and around them." It perhaps requires some power of abstraction to be able to form a just conception of this definition. I will endeavour to give an outline of his argument; but to understand this, it is necessary to know something of electrical conduction. Most persons know that, in relation to electricity, substances are divided into conductors and non-conductors; the first, as the name implies, conducting electricity, or allowing it to pass readily through them, while non-conductors considerably retard, and some of them nearly stop its passage.

In the former view of matter, we have seen it described as consisting of particles with spaces between them; imagine a vessel filled with shot, but each shot not touching its neighbours, and water poured between the shot; the shot would then represent the atoms, and the water the space. In representing a gas, say

oxygen, in this way, if we suppose the shot to be the 25th of an inch, each little sphere would be nearly 7 feet from the next. Certainly it is difficult to conceive of one of the most useful, active, and positive elements in nature, being composed of so great a proportion of nothing, and I do not know how otherwise to express it according to this theory; unless we consider heat to be matter, steam must also be described as a little water and a great deal of nothing, and the steam engine would owe its gigantic strength to the wonderful power of this nonentity. If space is the only continuous part of oxygen, which is a non-conductor, the natural conclusion is that space itself is a non-conductor.

The following is an extract from Faraday: "If the view of the constitution of matter referred to, be assumed to be correct, and I may be allowed to speak of the particles of matter, and of the space between them, as two different things, then space must be taken as the only continuous part. Space will permeate all masses of matter in every direction, isolating each atom from its neighbour. Then take the case of a piece of shellac, a non-conductor, and it would appear at once from such a view of its atomic constitution that space is an insulator; for if it were a conductor, the shellac could not insulate whatever might be the relation as to conducting power of its material atoms. Next take the case of a metal constituted according to the atomic theory, in the same manner. The metal is a conductor, but how can this be except space be a conductor? for it is the only continuous part of the metal, and the atoms not only do not touch (by the theory) but as we shall see presently, must be assumed to be a considerable way apart. Space, therefore, must be a conductor, or else the metals could not conduct. It would seem, therefore, that in accepting the ordinary atomic theory, space may be proved to be a non-conductor in non-conducting bodies, and a conductor in conducting bodies; but the reasoning ends in this, a subversion of that theory altogether; for if space be an insulator it cannot exist in conducting bodies, and if it be a conductor it cannot exist in insulating bodies." He then instances potassium and some of its compounds, which certainly present very striking phenomena in support of his theory. Potassium is a metal discovered by Davy as the base of potash or potassa, which is a combination of potassium and oxygen; like all other metals it is a conductor of electricity, while potassa is a non-conductor. Now, it is a singular fact that a piece of pure and solid potassium contains less of itself than a piece of potassa of the same size, which contains besides the metal oxygen and water. For the sake of illustration, we will suppose 40 ounces of potassium would fill a quart, you may add to it 8 ounces of oxygen (which in the gaseous form would be about 40 gallons), and 9 ounces of water, and then instead of filling the quart, the mixture would be less than a pint and a half; or to put the same into chemical language, if a given bulk of potassium contains 45 atoms, a piece of potassa of the same size contains 70 atoms of potassium and 210 atoms of oxygen and hydrogen. It evidently follows, by the old theory, that there must be much more space than matter in this metal, and as it is a conductor, space must also be a conductor. To any one who has followed through this argument, the contradiction with respect to electrical conduction must be evident. To meet this difficulty Faraday has adopted the theory before mentioned, that the final constituents of all material objects consist, not of inconceivably small, impenetrable, defined particles, but of centres of forces, which, like mathematical points, have no magnitude, but the extent of the space over which the forces of each individual atom operate may be extremely variable. As an illustration, we may take a candle; imagine the flame to represent one of these infinitely small centres, the effect, or operation, or force of it is manifested throughout the room by the light it sends to the utmost corner, and we imagine this to represent one atom of matter (only you must remember what has been said about the size of these minute particles); by the old theory another atom could only approach it, and must remain outside the room, but by admitting the truth of the theory, I have endeavoured to explain, I can bring two centres of forces into immediate contact, and the forces themselves can be mutually blended and conjointly diffused, as we see is the case with the light emanating from two candles. If we place them an inch or a yard apart, the space between

them is still filled with light; so if these centres of forces are more or less diffused, they form but one continuous mass of matter in its aggregate state; and hence the particles of the most subtle gas may be said to touch each other as much as the particles of the densest metal, which seems more consistent with experience and observation. With regard to the shape of the atoms, as it is evident they may be compared to extremely elastic bodies, their form would vary with circumstances, but probably their tendency would be to assume a spherical figure. This view of matter seems to discard the doctrine of its impenetrability, and who can deny that two particles of matter do actually occupy the same space at the same time, for, as we have said, 280 parts by weight of hydrogen and oxygen can be put into 70 parts of solid potassium, and then the whole of the mixture will only take up the room of 45 parts of potassium? This view of the penetrability of matter seems almost necessary in connection with organic chemistry. No doubt you are all aware that everything around us, and our own bodies as well, are compounds made up of two or more elements, so named from the fact that they have never been decomposed, or resolved into other kinds of matter. All the materials of this globe, at least all that have as yet been submitted to the searching scrutiny of the chemist, the treasures of the mineral world as well as the infinitely varied forms of the animal and the vegetable kingdoms, may be resolved into 54 elements or distinct varieties of matter, each of which has its own individual peculiarities that constantly attend it and distinguish it from its neighbours; 41 of these are metals, 20 of which have been discovered during the last fifty years, and some of them, as you may naturally conclude, are very rare. The great bulk of the animal and vegetable world is composed of carbon or charcoal, and three gases, oxygen, hydrogen, and nitrogen; but I am now trespassing on chemistry; it is necessary, however, to illustrate what I was about to refer to, to say, that these elements mix in very various but definite proportions to produce the substances that surround us. Sugar is composed of 12 atoms of carbon, 9 of hydrogen, and 9 of oxygen; thus, 30 simple atoms are necessary to compose one atom of sugar; perhaps some persons may think it would be as well to say that it is composed of four of carbon, and three of hydrogen and oxygen, as the proportions are the same; but a study of organic chemistry would show that this is not the case. Now if these little atoms are clustered together like thirty marbles, or, on the supposition that different kinds of matter have different shapes, we may imagine a single particle of sugar built up of twelve minute marbles, nine little dice and nine diamonds, then what a composite little thing an atom of sugar must be; we may fancy it ever ready to tumble to pieces. If it be so with sugar with only its 30 atoms, how must it be with bile, one atom of which, according to Leibig, is made up of 166 simple atoms. If I have succeeded in giving you a clear notion of Faraday's meaning, you will perceive it is far easier to conceive one of these complex atoms; instead of imagining 20 or 100 inconceivably minute, but well defined and extremely hard simple atoms clustered together, and each existing in the compound atom in its individual identity, and occupying its own portion of space; is it not easier to suppose so many centres of forces, which of themselves occupy no portion of space, coalescing and yielding their distinctiveness of character to give one collection of properties, and one character to the compound atom?

There is another class of the affections of matter which are not generally regarded in the same light as the universal properties to which I have already referred: I mean light, heat, and electricity. These are sometimes called the imponderables, as being a kind of subtle matter without weight; thus we speak of the electric fluid. Sir Isaac Newton described light as matter emanating from the sun, and this opinion seems to have been generally received for some time; it is called the Corpuscular Theory; its opponent is called the Undulatory Theory, and supposes a universal ether, and that the various phenomena of light, &c., are produced by undulations or waves in this ether, as sound is produced by a peculiar undulation or vibration of material objects.

Grove has broached another theory. He considers this mysterious but all-important triumvirate of light, heat, and electricity as belonging to the general and universal

properties of matter. He describes them as various modes of motion or developments of forces, which may be resolved from one to the other; thus—heat produces motion in the steam-engine, motion produces electricity in the electrifying machine, and *vice versâ*, in electromagnetic machines, motion produces light and heat in the lucifer match. In his lectures at the London Institution, Grove exhibited an apparatus, by which, from the action of light, he produced motion, electricity, heat, magnetism and chemical action. All this could be more clearly and interestingly explained with the aid of apparatus which it is one of the objects of this institution to provide, as far as its funds will allow. It is only very partial and imperfect views of these subjects that I have the opportunity of taking, but, if I may be allowed to express an opinion, I feel very much inclined to this notion of Grove's, that the imponderables should be deprived of their supposed independent existence and be classed with the properties of matter.

According to these views, what we call matter, consists of an embodiment of the following properties: Extension, Figure, Solidity, and Divisibility; these may be called passive properties, and then, joined with them, are the positive and active properties.—Attraction in its various forms, and the development of Light, Heat, and Electricity. Inertia and Indestructibility may be called negative qualities.

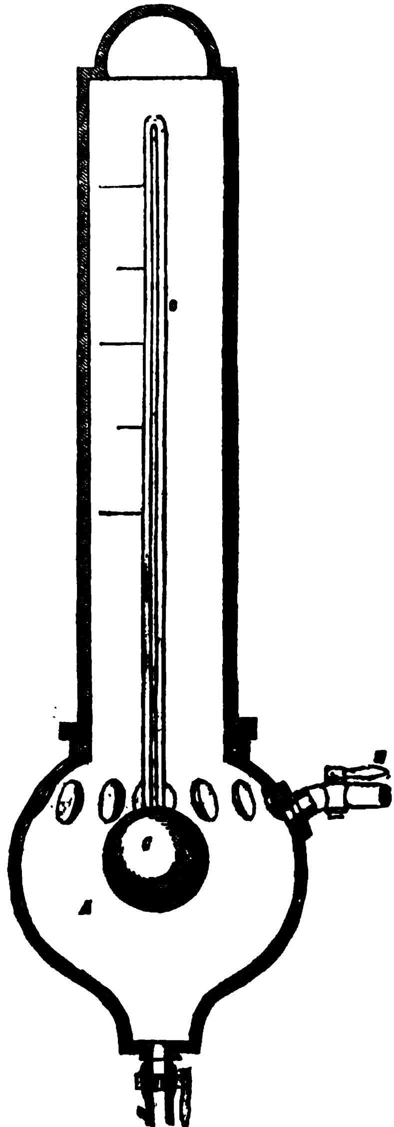
I ought perhaps to have introduced indestructibility before; it is a fact, that however matter may be changed in its form and appearance, it is never destroyed—portions of these candles have disappeared, but they are only changed into water and gas: part of what we have eaten to-day has been passing from our lungs every moment that we have been in this room, but it is not destroyed—it is now in the air, it will go forth, and will again, sooner or later, be fixed in a solid form by being abstracted from the atmosphere by vegetables. It is possible that the very carbonic acid we now expel from our lungs may float about in the air until it reaches our own cabbages, and be then absorbed by them, and again eaten by us; and thus matter runs through its perpetual changes.

Let us imagine the biography of an atom of carbon ushered into existence by the Almighty word, ages before the creation of Adam. It underwent unnumbered vicissitudes ere this world and system arrived at a mature state of organization and life; perhaps at length it formed a portion of some gigantic crocodile, whose remains may be now slumbering in the British Museum, but which then sported in the vigour of life. Passing through his system it was ejected from his lungs and floating in the air, came in contact with a magnificient fern of the preadamite world and was fixed in a vegetable form. Some mighty catastrophe befals this part of the globe, and this graceful specimen of the vegetable world, with thousands of others, is carried into a lake, and in process of time is embedded in the bowels of the earth. There it lies, while millions of its fellow atoms continue their never-ceasing changes, and mighty events are writing their own history on the surface of our globe in characters to be deciphered in after ages by the geologist. Animal and vegetable life ceases from causes only known to the Great Ruler and Disposer of every particular atom, as well as of the whole universe; but, although every thing is now death-like, nothing is destroyed—all the materials of which this world was originally created exist, but now all is without form and void, in a state of general ruin—the atom we have singled out still existing in the interior of the globe. The Spirit of God now moves, and the new creation arises—not that any matter is now created, but life is again put into motion—our earth emerges from its millenial winter and its spring-time is again arrived—the active properties of matter are busy with renewed vigour, vegetables spring up, animals again show themselves, and at last Man is made; he runs through 6,000 years of his eventful history, and then this atom of carbon is moved about for the first time by some brawny collier in Wales, and it finds its way here. Crack a piece of that coal, and you expose to view many particles of carbon which may have gone through the vicissitudes I have imagined. Let us follow this atom a little farther; suppose it to be one of those now passing out through the chimney into the atmosphere—it may be wafted before long to the spicy groves of the Tropics, there again to assume a vegetable shape and

come back to us embodied in a nutmeg; and as it has now comforted us by its heat, it may then, after gratifying our palate, and forming a part of our body as it did of the crocodile some 10,000 years ago, pass into the atmosphere and be caught by some long enduring oak, to await the final doom of all things.

I have indulged in an imaginary history of one atom, but it is founded on fact, and may have been a thousand times more varied, and as I have represented to be with one atom, so it has been, and will be with millions on millions, a million times multiplied and remultiplied. Each keeps the laws prescribed at its creation, and each is followed by the all-seeing eye of its Creator. What an idea it must give us of His infinite wisdom and power! But this minute view is only one side of the question; we should think of the extent of the universe of matter; and we require the powers of the poet, as well as the searchings of the philosopher, to give an adequate idea of this part of the subject. Try to conceive of what we have stated as belonging to every single atom of matter, all its properties, and then its size—so small that, probably, each one is not the millionth part of an animal a million of whom would hardly be perceived by us. It is impossible for us to dive into such depths, and we are equally incapable of soaring aloft, and forming a just conception of the extent of matter. Imagine yourself in adjacent Park; pluck a blade of grass; consider its elaborate organization; try to form some estimate, if you can, of the number of atoms in it; then think of the number of blades of grass in the Park, together with the other forms of organized matter—as the leaves of the trees, insects, each hair on the back of every deer, &c.; imagine England equally full of matter, as carefully and incomprehensibly elaborated; then the world: and what is the world to the suns—to the Solar System, which is all matter, and probably equally organized, and as full of interesting variety and life as our earth! Then rise higher, and the whole Solar System (inconceivable as its extent is to us) sinks into an insignificant spot in comparison with the suns and systems that our telescopes reveal to us; and we know not but that even these may be only but a small fraction of the kingdom of matter;—and yet all is less than a handful in the estimation of its great Creator, and it is but the scaffolding—the stage for the development of a far more important order of being—the world of spirits to which we belong!

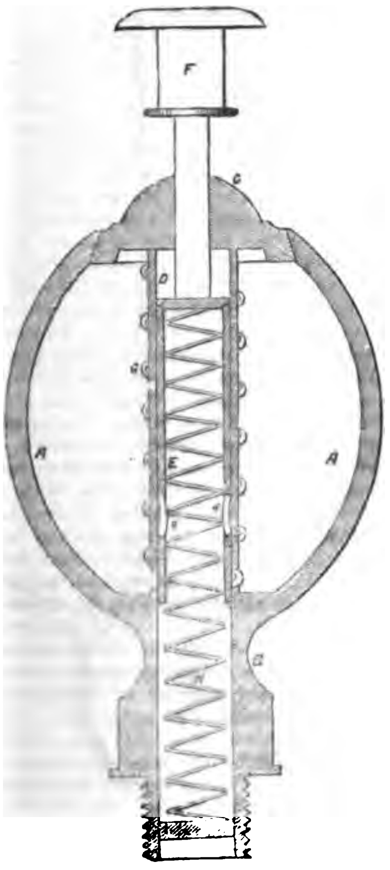
SPRAY'S PATENT SALINOMETER.



A is a spherical vessel connected

to the boiler by the pipe and stop-cock B; C is a thermometer, which is placed in a chamber mounted on the top of the spherical vessel A. If water be allowed to flow freely from the boiler into the vessel A, and through the pipe D, until the whole has come to the boiling point of the water under the ordinary pressure of the atmosphere, then the temperature indicated by the thermometer at that instant will also indicate the density or saltness of the water in the boiler.

SPRAY'S PATENT LUBRICATOR.



The above figure represents a helical section of this improved lubricator. A is a cup for holding the oil or other lubricating substance; B a screwed stem by which it is attached to the cylinder: C is a conical valve, which is fitted into the mouth of the cup A, and serves to prevent both the entrance of dirt or the escape of steam; D is the spindle of the valve, which is made hollow and bored truly inside, for the reception of a tube E, which has attached to it the spindle and handle F. The tube E is accurately fitted both into the stem B, and into the valve-spindle D, and capable of being moved up and down within them; G is a helical spring which keeps the valve C up against its seat, and H a second helical spring which keeps the tube E pressed up within the spindle of the valve. The lubricating material is introduced in the first instance into the cup by pressing down the valve C, and when it is desired to lubricate the piston of the engine, the handle F is pressed down, which causes a small hole *a*, formed in the side of the tube E, to come below the end of the hollow spindle of the valve; the oil then flows through it into the interior of the tube, and thence through the stem of the cup into the cylinder; upon lifting the hand, the helical spring H causes the tube to ascend and stop the flow of the oil.

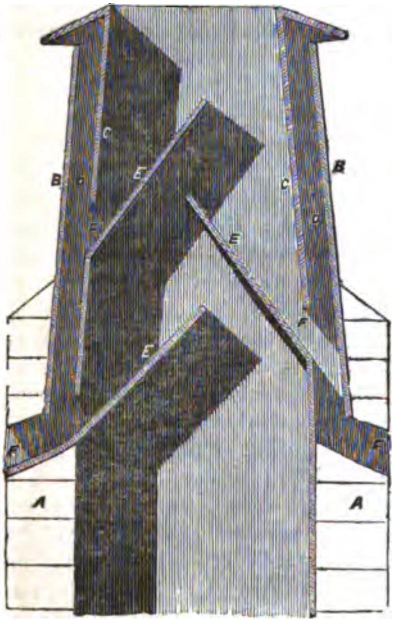
PILBEAM'S SMOKE-PREVENTING CHIMNEY-POT.

[Registered under the Act for the Protection of Articles of Utility. William Pilbeam, of Acton-street, Gray's-inn Road, Builder, Proprietor.]

Figure 1 is an elevation in section of this chimney-pot. AA is the brick-work of the chimney; BB the outer case of the pot, and CC, an inner one. Between B and C there are formed passages or flues, DD; EEE are deflecting leaves, which are fixed in inclined positions within the inner case CC; FFF are apertures which are formed in the sides of the inner case, and communicate with the passages DD, and are open to the external atmosphere both at

top and at bottom. Should a current of air enter at the bottom of the flue, it ascends in the inner case, and carries the smoke up along with it, while, if the

Fig. 1.



wind should blow down into the mouth of the pot, it is intercepted by the deflectors and carried off into the atmosphere through the apertures FFF, and the passages DD.

THE SMALL ARMS OF VESSELS OF WAR.

Although naval force is generally considered as consisting of vessels and ships armed only with what are called great guns; yet, in point of fact, portable arms are also furnished to them, and have on many occasions been used with great advantage, at the same time with great guns.

A ship, though armed with a hundred guns, if aground, or in certain states of the weather, or in other cases of accidental occurrence, may be incapable of throwing shot from the great guns so as to reach the enemy in certain directions. In such cases, the effective force of the vessel will be limited, or nearly so, to the destructiveness of such portable implements of warfare as each combatant can carry about and apply to use by his muscular force; besides which it is principally from such implements that success is looked for on the frequent occasions of boarding an enemy's vessel, or resisting his attempts to board our own.

For warfare of this description, besides the various sorts of cutting weapons, as cutlasses, swords, pikes, dirks, bayonets, axes, &c., missiles are employed—as rockets, hand-grenades, and shot fired from muskets, rifle-guns, pistols, &c.; it cannot therefore but be of considerable importance to inquire into the efficacy of these portable instruments of destruction, the more so as they seem to have been (like the great guns used for naval warfare) originally the same as those used for service on land. Inquiry would probably show that little has been attempted to adapt portable arms to the peculiar circumstances of *naval* warfare.

The destructiveness of an implement for cutting will depend on the shape and form of its edge, on the position of its centre of gravity, on the commodiousness of its handle, and on its weight being suited to the muscular strength and dexterity of each individual combatant. Should, therefore, its edge, or the whole weapon, be made straight or curved—in a convex or a concave line? In what part should be the centre of gravity?—What is the form best suited to piercing as well as cutting?—What is the best form of handle that favours the surest grasp, and best protects the hand?—What difference should there be in the weight and size of such arms, with a view to their appropriation to men of different degrees of stature and of strength? Not one of these points has as yet been properly ascertained, and all of them are suitable subjects for experiment.

Portable fire-arms for naval service afford ample scope for experiment, as to their different degrees of portability especially:—what size and weight of a light and little-cumbersome arm, like a pistol, would be the most destructive, yet capable of being carried about the person, and leaving the hands free for other services? Whether some other variety of fire-arm might not be more useful on ship-board than the musket? Whether some portable arm, within the muscular power of a single man, might not be provided with some support when in action, especially for taking aim and

against recoil? Although portability be a very essential consideration in regard to the fitness of an arm for boarding an enemy's vessel, yet might not some portable fire-arm, more destructive than the small arms in use, be devised as a defence against an enemy's boarding?

What are the missiles, such as hand-grenades, rockets, &c., or new ones that might be devised, which could be thrown by hand or from portable fire-arms, which would be most injurious to an enemy's vessel by setting it on fire or otherwise? — *From the Unpublished MSS. of the late Brigadier-General Sir Samuel Bentham.*

FENN'S REGISTERED CYMAMETER.

Registered Under the Act for the Protection of Articles of Utility. Joseph Fenn, of Newgate-street, London, Tool-maker, Proprietor.]

Fig. 1. Fig. 2.

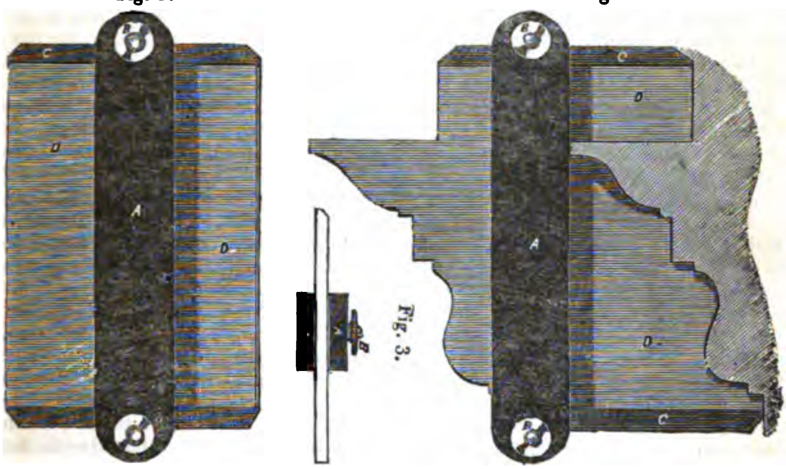


Fig. 3.

The object of this invention is to enable architects, archaelogists, and others to make readily accurate copies of the outlines of capitals, cornices, and other architectural ornaments, by actual application to the objects themselves; and certainly nothing more convenient or suitable for the purpose can well be imagined. Fig. 1 is an elevation; fig. 2 is a cross section, and fig. 3 shows this instrument in use; AA are two side pieces which are held together by screws, BB; CC are two cross bars which are inserted into a slot formed between the side pieces; the space intervening between the cross bars, CC, is filled with a number of thin laths, DD. When the instrument is applied to any moulded or irregular surface, the laths, DD, slide back, and take the form against which they are pressed. The inside surfaces of the side pieces, AA, are covered with leather, so that the laths may be retained in any position in which they are placed.

VIDIE'S PATENT RAILWAY SIGNALS.

(Patent dated November 2, 1849. Specification enrolled May 2, 1850. Patentee, Lucien Vidie, Paris.)

Abstract of Specification.

The object of this invention is, to indicate to railway and steam-boat travellers the station at which the train or vessel is stopping or about to stop; and also to enable them to communicate with the guards when required.

Figs. 1, 2, 5, 6, 7, and 8 represent the two principal apparatuses contrived by the patentee.

In fig. 1, *a* is a cloth, on which are inscribed the names of the stations, and which is to be wound up on the drums *b* and b^1, when passing in the inside of the vehicle, by means of three sliding pullies *c, c, c.* Each drum is put in motion by a spring,

which is bent in causing the shaft *d* to rotate. This shaft is provided with a bevel-wheel *e*, fig. 2, having a catch to prevent it receding. The spring, the barrel *f*, and nave *g* are free to travel to and fro on the shaft *d*; but the nave *g* is fixed thereon. The rotation of the barrel *f* gives the necessary movement. On each side of the barrel *f* are cogs, *f′*, *f″*, and when the barrel *f* is moved towards the drum *b*, the cogged part *f′* comes in contact with the catch *k*, set on the drum, and compels the latter to turn. When, on the contrary, the barrel *f* is drawn back to the opposite side, the cog *f′* leaves the catch *k*, which allows the cloth to be unrolled, and the other cog *f″* is made to bear against the fixed catch *l*. The motion of the barrel is obtained by means of the lever *h*, put in motion by turning the screw *i* to and fro, which pushes the piece *j*, to which the lever *h* is joined. Each drum, *b* and b^1, is provided with a similar apparatus, and the lever *h*, acting in a similar manner, but in a contrary direction, it is sufficient for a journey up or down when the train is starting, to turn the screw *i* on the right or on the left side, to cause the acting of a drum spring, which is bent in before or after; and, at the same time, the action of the spring of the other drum is suspended.

To prevent the cloth from slackening when left to itself, on the other extremity of each axis *d*, by its nave *m*, is fixed a weaker spring, having its barrel *n* fixed to the drum, which always maintains this last at a certain degree of tension.

To stop the cloth at the required words, and to change the last, there is placed between each bill or printed warner an iron cross-piece a^1, having its extremities jutting out on each side, and made to reach the forks *f′*.

A crank lever *q*, put in motion at one end by a rod *o*, is provided on the other end with a groove *q′*, which, by describing the segment *q*, a^2 takes off the rod a^1, and draws along the cloth of a length sufficient to disengage the rod a^1 of the fork *s′*. This last fork is set on an axis which permits it to oscillate between two stopping points, from the position in which it is represented, to one place similar to that of the other fork *s*, and towards which either a counterweight or a small spring will suffice to bring it back as soon as the rod a^1 leaves it. The lever *q*, returning to the opposite side, allows the cloth to go down, without the rod a^1 being stopped by the fork; but the rod a^2 being connected with the groove, and obliged to follow it within the segment described by it, is compelled to stop on the said fork *s′*. The latter, on account of the tension of the cloth, and being, besides, assisted by its own inclination, returns to its preceding position as soon as the groove, by continuing to descend, allows it to do so. The lever *q* can at that moment ascend towards another rod without meeting the one it has just brought with it.

It is therefore necessary to have two grooved levers and two forks on each axis, in order to operate simultaneously on the two extremities of each rod, and two similar apparatuses are required to conduct the cloth either in one way or in another. To change the motion of this part of the mechanism, it is sufficient, when the position of the springs are altered (and the spring which is to act bent in), to hook one or the other of the crank levers *p*, *q* to the rod *o*, which, for that purpose, is provided with holes at convenient distances.

By a modification of the mode before described, a sufficient number of plates, connected together, may be used instead of cloth.

In figs. 5, 6, 7, and 8, the names of the places, or any other indications, are written on separate plates, which are caused successively to appear and to return to their proper places. They are constructed of thin plates of metal, and their edges embossed to form a kind of frame, and to give them more stiffness, and are placed in a box *a*, at equal and convenient distances, in parallel grooves fitted on each side of the box, but having their lower part widened, in order to facilitate the ingress of the plates. The box *a* works on two edged rails *b*, set on the frame *p*, as well as the covering of the apparatus. Each groove is made to present itself successively above the notch *c* of the groove *d*, in which the plates which are contained in the box *a* are made to descend and ascend one after the other. The nut or cog *e*, placed on the upper part of the box *a*, and, taking into the threads of the moving shaft *f*, gives motion to the box *a*.

The worms of the above-mentioned shaft *f*, which are represented in fig. 8, may be circular on the three-fourths of its length, and made helixwise on the other part, where they are made to join the next threads. In this fig. the cog *e* is represented

Fig. 1.

Fig. 8.

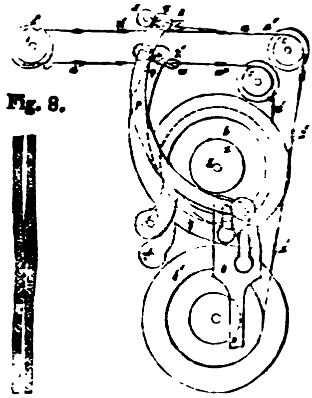


Fig. 2.

Fig. 7.

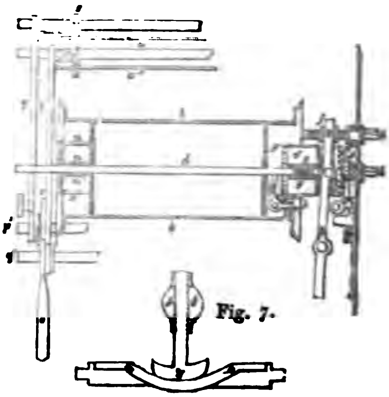


Fig. 3.

Fig. 4.

Fig. 10.

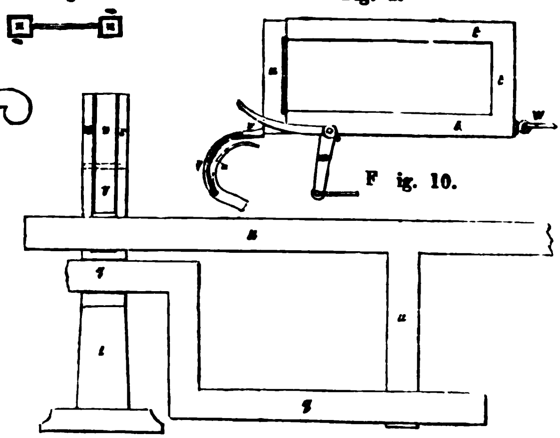


Fig. 9.

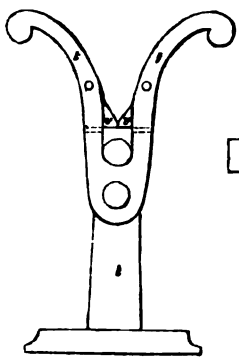


Fig. 6.

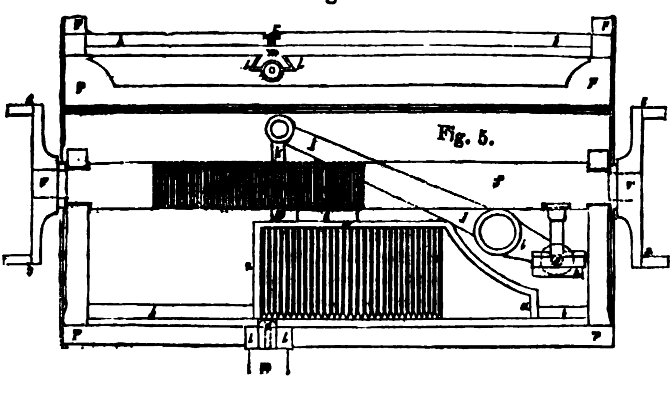


Fig. 5.

between the two threads in the shape of a rhomb, to facilitate its motion between the straight and inclining parts. When the apparatus is in a state of rest, the shaft *f* presents to the nut *e* the middle of the circular part of its worm, and it therefore can be made to turn a quarter of a revolution, for example, on account of the oscillation of the train, without altering the position of the other parts of the apparatus; but if it is caused to turn more, it presses a tumbler *g* on a lift *h*, suspended between the two arms *i* of a lever balance; the other arm *j* of the said balance lever, by means of the two connecting rods *k*, cause the rings *l*, *l*, *l* to travel to and fro, which envelop two guides *m*, fitting on each rail, and between which each plate is made to descend in the grooves *d*.

The inside part l^1 of these rings, which prevents the plates from falling in the groove *d* during the motion of the box *a*, is slightly rounded on its upper part, and juts out slightly also above the rail at the place where it crosses the notch *c*, in order to avoid more certainly any stoppage.

The connecting rods *k* are made to act on the rings *l*, *l*, *l* by means of springs placed in a tubular piece *o*, instead of having the connecting rods attached directly to these said rings *l*, *l*, *l*, by which contrivance the great nicety required to bring and maintain the rings *l*, *l*, *l*, at a convenient elevation is avoided. The balance lever can therefore, after having conducted the rings *l*, *l*, *l*, to a proper stop, continue its journey by bending in the springs to a sufficient extent capable of obviating the irregularities and wear of machinery.

The tumbler *g*, after having pressed the lift *h* of the required amount, meets on the last with a part which is cylindrical and concentric to the shaft *f*, and continues therefore to advance, maintaining at the same time the balance lever in the same position. At this part of the rotative motion, the shaft *f* is to connect within the nut *e* the slanting part of its thread, which causes the box *a* to move; and it is during that time also that the shaft *f* brings another plate in the place of the former one above the notch *c* and the groove *d*. The tumbler *g* continuing to turn, causes the lift *h* to reascend, and the arms *j* of the balance lever to descend, conjointly with their connecting rods and the rings on which the new plate is resting.

When the journey is performed, and the train is to return, it is merely necessary to turn at every station the shaft *f* in the opposite direction, to bring the names of the stations or warner in a contrary position.

Figs. 9 and 10 represent the means of transmitting the motion, before described, from one vehicle to another. A shaft, *q*, is set at one of its extremities in the hole *r*, prepared within the shaft *f*, fig. 5, and gears into the last by means of a cross-piece, which is connected to the fork *s*. The axis, *q*, passes to the forepart of the vehicle through the bearer *t*, fig. 9 and 10, and is bent like a crank-arm. The shaft which is to communicate the motion given by the conductor to the fore-part, is constructed by means of disconnected pieces on the back part of each of the vehicles. The prolongation of that shaft is taken off, and thrown in the upper open part of the support *t*, and causes, by means of its cross-arm, *u'*, the crank-arm of the following vehicle to turn.

The apparatus may be placed on the side of the vehicle, the door of which is not to be opened during the journey, instead of placing the apparatus in the middle of the vehicle. The apparatus is put in motion by two bevel wheels and a transversal axis. To simplify the mechanism for transferring the motion from one side to the other, the lateral wheel is set either higher or lower than the other, and the transversal axis is made to pass freely through the said wheel, the nave of which is made to rotate on a bearing. To each end of the nave there are fitted two forks, similar to those represented at the extremity of the shaft *f*, fig. 5. When the apparatus is to be brought from right to left, it is sufficient to push the axis through the wheel. The end of this axis, which, in contact with the fork *j*, is made to catch the fork set on the right side of the nave of the wheel, and the end which was in contact with the fork of the left side, catches in its turn the shaft *f*. The apparatus represented by figs. 1 and 2, would be better set on one of the sides than in the middle of a vehicle, because the names can only be seen on one face, unless they are repeated, and the cloth made to work three times more. If the apparatus is caused to act by means of a rod and an excentric set on a cylindrical shaft, it suffices to reverse these

two last; if, however, it is desirable to set the apparatus in the middle, it would be easy to have it put in motion by a square lever.

The apparatus may be made to act from the deck of a vessel into the cabins, by means of a horizontal or vertical axis, or by any other convenient and known mechanism.

The patentee proposes to give notice, from the inside of the vehicle, to the guards of the trains to open the door, by the apparatus represented in figs. 3 and 4; *u* is a board painted white, on which is written the word "Open." The board *u* slides in a box *t*, painted black. A spiral spring placed in the frame of the board *u*, causes it to project from the box *t*, as soon as a passenger by pulling the string of the lever *z*, lowers the stopper *v*. This catch, *v*, is set between the arms *x* and *y*. The box containing the written board *u*, is fixed transversely in the vehicle, and the pieces *x* and *y* on the door; so that the shutting of this last causes the board *u* to re-enter the box *t*, without any more trouble; a similar apparatus may be set on each side of the vehicle, in which case the same string will be tied by its two ends to two crank-levers, and the two boards *u*, will communicate to each other the movement by the connecting spindles *w*, and the balance lever set between these spindles *w*; it will be sufficient to shut only one door to force the two boards into their proper places. Every kind of written communication can be given by the apparatus before described. A board with painted words may be used when there are but few stations. To the circumference of which is fixed a cog wheel, which gears into a small wheel fixed in the motive shaft, at each revolution a word or notice will be exhibited; the other words being concealed or outside the vehicle.

For the claims, see vol. lii., p. 377.

NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Continued from vol. lii., p. 490.)

Third and Concluding Series.

III.—CUBIC EQUATIONS.

The venerable and distinguished mathematician MR. JAMES LOCKHART, of Fasnacloich, Argyllshire, has done me the honour of sending me a copy of a little work, which he has recently published, on the "Nature of the Roots of Numerical Equations."* I propose to apply to three examples, taken from his work, the process which I gave, at pages 489—490 of the last (52d) volume of this Journal, for ascertaining the nature of the roots of cubic equations.

Ex. 6.—What is the nature of the roots of the equation

$$x^3-2x^2+3x-1=0\,?$$

(LOCKHART, p. 6, line 3.)

My process, applied to this cubic, gives,—

$$\begin{array}{rrr}
-2 & 3 & -3 \\
-2 & -2 & -2 \\
\hline
4 & -6 & 6 \\
9 & -9 & 9 \\
\hline
 & 2)3 & \\
\hline
-5 & 1{\cdot}5 & -3 \\
 & & -5 \\
\hline
 & & \dagger\ 15 \\
 & (1{\cdot}5)^2= & 2{\cdot}25 \\
\hline
 & & 17{\cdot}25
\end{array}$$

hence, the result being positive, the given cubic has two unreal roots. The last step of the above process might have been omitted, since, whenever the quantity corresponding to that marked with the obelisk(†) is positive, the final result is so. When that quantity is *negative* it is not always necessary to work out the final result. Mere inspection will often suffice to inform us of the sign which that result will take.

Ex. 7.—What is the nature of the roots of the cubic

$$x^3+24x^2-30x+10=0\,?$$

(LOCKHART, p. 10, *Ex.* 6, line 6.)

* London. Printed by C. and J. Adlard, Bartholomew-close. 1850.

Our work here is

24	−30	30
24	24	24
576	−720	720
−90	90	900
666†	2)−810	−180†
		666
	−405	53280
		666
		−119880
	$(405)^2 =$	164025

It is not necessary to proceed further even than this. Mere inspection shows that two of the roots are unreal. I may here observe that, whenever the quantities corresponding with those which, in this last example, are marked with obelisks, have *the same sign*, the given cubic has two unreal roots.

Ex. 8. What is the nature of the roots of the cubic

$$x^3-10x^2+12x-4=0?$$

—(LOCKHART, p. 10, Ex. 6, line 4.)

−10	12	−12
−10	−10	−10
100	−120	120
36	− 36	144
64	2)− 84	−24
		64
	− 42	
		96
		144
		−1·536

We need go no further. We at once see that the final result will be positive, and, consequently, that the given cubic has two unreal roots. In each of these three examples of Mr. LOCKHART we have the relation

$$3c=-b;$$

Is this relation—and, I may add, is that which causes the number 666 to occur in the left-hand columns of *Ex.* 7 and *Ex.* 11—designed or casual?

The following example — one of STURM's — is treated by my eminent friend, Professor J. R. YOUNG, at p. 34 of his researches, "On the General Principles of Analysis," the First Part* of which has lately appeared.

* Published by C. C. Spiller, 102, Holborn-hill. Price Two Shillings and Sixpence.

Ex. 9. What is the nature of the roots of

$$x^3+11x^2-102x+181=0?$$

—(J. R. YOUNG, *Princ. of Anal.*, Part I., p. 34.)

11	−102	543
11	11	11
121	−1122	5973
−306	1629	10404
427	2)−2751	−4431
		427
	−1375·5	
		31017
		8862
		17724
		−1892037
	$(1375.5)^2 =$	1892000·25
		−36·75

and, the result being negative, *all* the roots are real. Although in some cases our process may be rather lengthy, it is always *easy* and *certain*.

I deeply regret to find, from a "Notice" on the cover of Part I., that the publication of Professor J. R. YOUNG's most interesting and valuable work *On the General Principles of Analysis* is for the present suspended, from the want of a sufficient number of subscribers. I trust that, when this obstacle to its continuance is more generally known to the mathematical world, the difficulty will be speedily obviated. To the tone of feeling which pervades the concluding paragraph of the "Notice" alluded to, I cannot forbear from here paying my tribute of respect.

I take another example, from p. 37 of Professor YOUNG's work.

Ex. 10. Determine the nature of the roots of

$$4x^3-9x^2+6x-4=0.$$

Multiply this equation by 2, and make $2x=y$. Then we have

$$y^3-4{\cdot}5\,y^2+6y-8=0;$$

the roots of which are of the same nature as those of the equation in x. Hence

− 4·5	+ 6	−2 4
− 4·5		−4·5
2 2 5		18 0
18 0		90
20·2 5		108·0
18		36
2·25		72

and, the quantities at the bottom of the right and left hand columns being both positive, the given equation has two unreal roots. Hence we see that, in the present case, it is useless to work the middle column. In fact, in all cases, it will be better so far to vary the rule, which I gave at pp. 489—490 of the last (52nd) volume of this Magazine, as to begin with the extreme columns, and only to work the middle column when the results of those extremes, carried as far as in the last example, are of different signs.

The following equation (quoted from Mr. LOCKHART), is treated by Professor YOUNG at p. 80 of his work above mentioned.

Ex. 11.—What is the nature of the roots of

$$12x^3 - 120x^2 + 326x - 127 = 0?$$

Since $12 = 3 \times 2^2$, multiply this equation by 18 (or 2×3^2), and make $6x = y$, and the resulting equation is

$$y^3 - 60y^2 + 978y - 2286 = 0.$$

Here we have

−60	978	−6858
−60	−60	− 60
3600	−58680	411480
2934	−20574	956484
666	2)−38106	−545004
	−19053	

For convenience, I shall perform the residue of the process below:

$$\begin{array}{r} 545004 \\ 666 \\ \hline 3270024 \\ 3270024 \\ 3270024 \\ \hline -362972664 \\ (19053)^2 = 363016809 \end{array}$$

We now see that the given equation has two unreal roots. Although the numbers here employed are large, yet, there being nothing tentative in our process, we are sure of arriving at a satisfactory result.

In the equation which constitutes example 8 of the last of these Notes (see *Mech. Mag.*, vol. lii. p. 489, col. 1), *for* 9 *read* 3.

JAMES COCKLE.

2, Pump-court, Temple,
July 6, 1850.

Postscript.—July 9, 1850. With reference to a passage in Art. (5.) of p. 7 of Professor J. R. YOUNG's new work, alluded to above, I take the opportunity of observing that, in the years 1847-8 (and some little time before the period there mentioned) I had contemplated the application, to the Theory of Equations, of GOMPERTZ's method of porismatizing Algebraic Expressions. This will be seen on referring to pp. 409—410 of vol. xlvii., and to pp. 181—8 of vol. xlviii. of the *Mechanics' Magazine*. In saying thus much, I must not be understood as laying any claim to Professor YOUNG's beautiful investigations on the roots of numerical equations.

JAMES COCKLE.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JULY 10TH, 1850.

DAVID BLAIR WHITE, Newcastle-upon-Tyne, M.D. *For an improved mode of ballasting and stowing cargo in ships and other vessels.* Patent dated July 8, 1850.

Dr. White proposes to place in the hold of a ship or other vessel four bags, two on each side of the keelson, are composed of stout canvass coated inside with gutta percha, or otherwise rendered air and watertight, and coated outside with coal tar, or impregnated with some poison to repel the attacks of vermin. The bags are to be further protected by being inclosed in netting, and secured by tackle to the sides of the hold, to prevent them surging fore or aft. On each side of the keelson there is a pipe which, passing through the stern, opens into the water beneath the line of floatation, and is provided with a cock. Each bag communicates with the tube on its side of the kelson by means of a flexible pipe, so that the two sets are separate and distinct; and it is provided with air holes at top to allow the air to escape when it is being filled. When it is desired to fill the bags, the cocks are opened in the stern, and the water allowed to flow into them through the way-tubes. The branch flexible tubes are each nipped together by instruments resembling nut-crackers, padded inside to prevent communication between the bags of each. By this arrangement the ship may be trimmed as required. When it is desired to carry such cargo as spirits, &c., the water is pumped out and communication cut off between the bags and the external water. In cases of wreck the bags may be emptied, when from the fact of their being distended by the tackle they will contain a certain amount of air, and serve to buoy the vessel. The pump

employed to empty the bags of water, or to fill and empty them with goods, is made with the lower extremity forked. One of the forks communicates by a curved pipe with one or other of the way tubes, and the other leads outside the vessel. The piston is placed in the fork communicating with the bags, so that in working, the water will only have to be lifted just above the line of floatation of the vessel. The pump barrel passes above the deck, and is provided with a branch pipe which may be closed or opened as required, when the goods are filled into or removed from the bags. To prevent sand from depositing in the pump and choking it, the patentee employs an agitator which is attached to the bottom of a rod extending the whole length of the pump, and provided with a handle at top.

ROBERT MILLIGAN, Harden, Bingley, York, manufacturer. *For an improved mode of treating certain floated warp or weft, or both, for the purpose of producing ornamented fabrics.* Patent dated March 18, 1850.

The patentee states that if, for example, it is desired to produce a light red rose on a dark grey alpaca, the mere printing of it on will not be sufficient to produce the desired effect, in so far as regards the distinctness of the design and vividness of the colour. He therefore proposes to float in carefully a warp or weft of a texture and colour suited to receive the tint, according to the design required to be printed.

Claim.—Printing in bright, clear, delicate colours on a warp or weft, carefully floated into a fabric according to the pattern, which is better suited to receive the colours than the ground of the fabric.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the preparation and manufacture of caoutchouc or India rubber. (Being a communication.) July 9; six months.

Robert Rumney Crawford, of Warden Paper Mill, Northumberland, paper maker, for an improvement in drying paper. July 10; six months.

Jacob Connop, of Hyde Park, Middlesex, gentleman, for improvements in melting, moulding, and casting sand, earth, and argillaceous substances for paving, building, and various other useful purposes. July 10; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
July 4	2363	John Ashford	Birmingham	Umbrella rail and water-box for church and chapel pew, carriage, and other doors.
5	2364	Joseph Foxall and Co.	Thavies' Inn	The triumfante pen.
,,	2365	Charles Wilford	Brompton	Rotary steam engine.
6	2366	William Collins, Jun.	Glasgow	Security envelope.
,,	2367	Thomas Purdon	Hull	Portable bureau.
9	2368	Thomas Yates	Birmingham	Preserve-pot for mustard, pickles, and other articles.
,,	2369	Anna Maria Breton	Lower Berkeley-street	Embroidering frame.
10	2370	James Carter and Johnson Wood	Lamb's-buildings, Bunhill-row.. 103, Leadenhall-street, City	Nautical state-cabin basin.

CONTENTS OF THIS NUMBER.

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Edited by J. C. Robertson, 166, Fleet-street.

DR. NEWINGTON'S NEW PATENT AGRICULTURAL MACHINES.

Fig. 4. Fig. 2. Fig. 6.

Fig. 1.

Fig. 5.

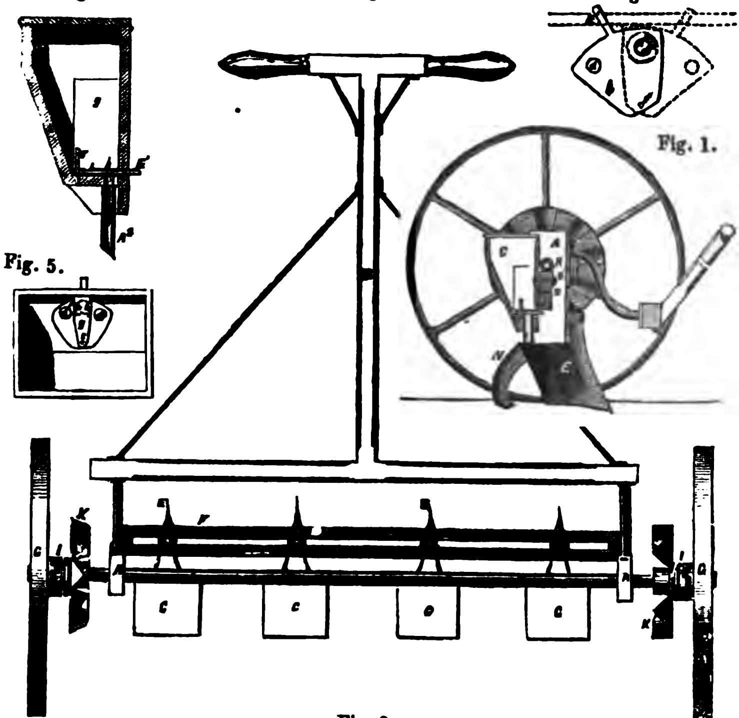
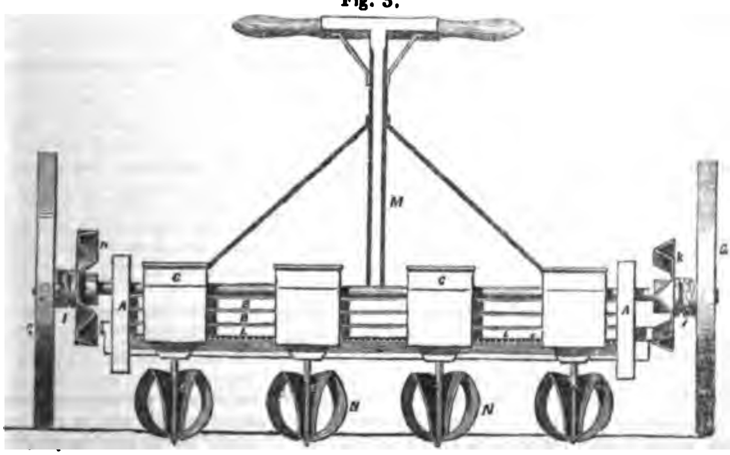


Fig. 3.



DR. NEWINGTON'S NEW PATENT AGRICULTURAL MACHINES.

[Patent dated January 11, 1850. Patentee Samuel Newington, of Knole, Trant, M.D. Specification enrolled July 11, 1850.]

THE high reputation which Dr. Newington has already acquired as an improver of agricultural instruments, will be found well sustained by the additional contributions which form the subject of his present patent. These consist—1. Of an improved hand-dropping drill, suitable for tilling and sowing. 2. A modification of the preceding machine, by which it is adapted to manuring. 3. Another modification whereby it is adapted to both sowing and manuring; and, 4. An improved subsoil pulverizer. We extract the following description of these machines from Dr. Newington's specification :—

The Improved Hand Dropping Drill.

Fig. 1 is a cross section; fig. 2, a plan, and fig. 3 a back view of this machine. AA is a framework, consisting of two upright styles connected together by means of cross rails, BB; CC are seed boxes which are secured to the framework by means of screws, DD; and EE are coulters (two, three, or more); one for each seed box, which are attached to a slotted bearing piece F, by means of screws and nuts as shown. Each seed box, should of course be on a line with its corresponding coulter; and the distance between the sets of boxes and coulters must be regulated (by means of the screws and nuts aforesaid), according to the width desired to be maintained between the rows of seed. GG are two wheels, upon which the drill is mounted; and I I, coupling boxes, by which those wheels may be connected to, or disconnected from the axle H, so as to allow of the machine being wheeled about from place to place without producing any action upon the seed-depositing part of the machinery, except when the coupling boxes are in gear with the wheels; KK are two rose or crown wheels with teeth of a Vandyck shape affixed to the axle H, which, on the rotation of the axle communicate an alternating motion to the bar L, which has its bearings in slots formed in the framework. Flat spaces are left between the teeth of the rose wheels which allow of the bar L, and the vibrating plates *b*, standing at rest, for the instant while the seeds are being dropped out of the cups d d^1. The wheels, KK, are so proportioned in size to the bearing-wheels GG, that a shift of the bar L is produced every 4 inches, which the bearing wheels travel over, and every shift of the bar causes a deposit of seed to take place from the whole of the seed boxes by means of the arrangement to be next described, and which are separately represented in fig. 4 and fig. 5; Fig. 4 being a vertical section of one of the seed boxes, and fig. 5 a plan of the same. A^2 is a pipe or spout, which is inserted into a hole in the bottom of the seed box, the lower end of which, when in its place in the machine, falls within the cleft of the coulter as represented in figs. 1 and 3; *b* is a plate which oscillates upon the centre *c*, and is provided with two holes, or cup-shaped seed recesses, d d^1, which are so disposed, that when the plate is made to move from one side to the other, they come immediately over the top of the spout A^2, and allow of the seeds which are contained in the cups falling through the spout. A plan of the plate *b* is given separately in fig. 6, where the black lines show it in the position which it occupies at one end of the stroke in one direction, and the dotted lines its position at the end of the stroke in the reverse direction. E^1 is a tail piece, which is formed on the plate *b*, and takes into one or other of the rectangular notches, *ff*, formed in a plate affixed to one side of the oscillating bar L, so that when that bar is made to oscillate by the machinery being wheeled over the surface of the ground, the seed recesses, d d^1, come alternately over the spout and drop their contents; *g* is a guard which is screwed to the front of the seed box (occupying a place immediately over the mouth of the spout A^2), and has a row of bristles, *h h*, affixed to each side of it, which serve to sweep off without bruising or injuring any surplus seed which may be contained in the cups, d d^1. When the machine is drawn over the ground by means of the handle M, the coulters form furrows into which each deposit of seed is regularly dropped at measured distances apart, and the earthing over the seeds is accomplished by means of blades, NN, affixed to back the ends of the coulters.

The Hand Dropping Drill as applied to Manuring.

Fig. 7 is a vertical section; fig. 8, a plan of the drill as thus modified. O is a hopper for containing the manure which extends across the machine from side to side; P a bar, which has its bearings in slots formed in the ends of the hopper, and is connected to the vibrating bar L, by means of arms, RR, so that the bar P partakes of the same movements as the bar L; *pp* is a plate or strip of metal which is affixed to one side of the bar P, and has its lower edge serrated, so that as it vibrates it causes the manure to flow in a regular and continuous stream from a longitudinal opening formed in the bottom of the

hopper; $p^1\,p^1$ are wires attached to the bar P, to prevent the manure from becoming choked or jamming in the upper part of the hopper; R^1 is a regulating plate which is adjustable by the screws SS, and by which the longitudinal opening in the hopper for the escape of the manure can be made of any size to suit the quantity of manure it is wished to deposit.

Fig. 7.

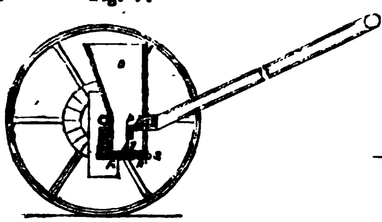


Fig. 10.

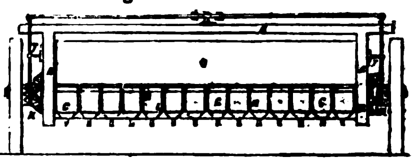
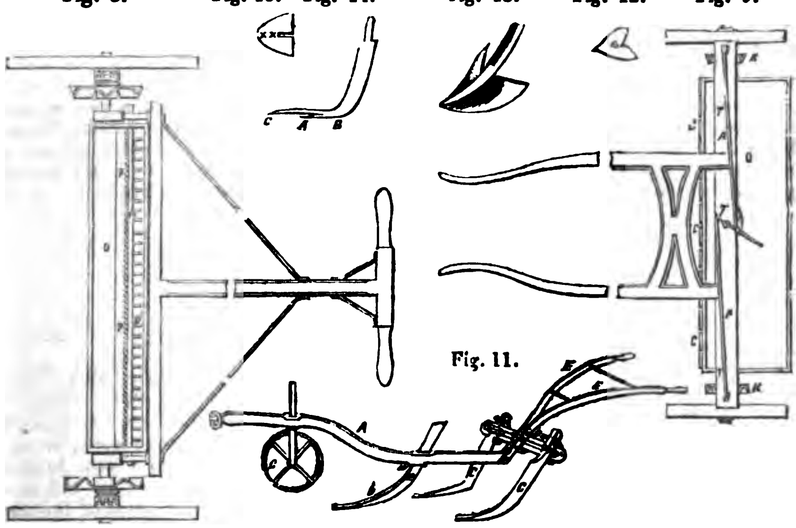


Fig. 8. Fig. 15. Fig. 14. Fig. 13. Fig. 12. Fig. 9.

Fig. 11.



The Hand-Drill adapted to both Sowing and Manuring.

Fig. 9 is a plan, and fig. 10 a front elevation of a double machine as thus modified. The framework of this machine is necessarily much stronger than that of the single machines before described, but the principle of action and the moving parts are nearly the same. A A is the framework; B B the rails to which the seed boxes C C are attached. The seed boxes are shown as attached to the front of the machine, in order that the moving parts which produce the distribution of the manure may stand quite clear of those which regulate the fall of the seed. O is the manure hopper, which is provided with a sliding bar P, and regulating plate inside of it, as before described. K K are the rose or crown wheels which give motion to the vibrating bar L, which again gives motion both to the sliding bar P and to the vibrating cup plates of the seed boxes. T T represents a system of leverage, by which the attendant can throw the bearing wheels out of gear with the shaft, and allow the machine to travel without either distributing manure or seed. No coulters or earthing blades are fitted to this modification of the machine, but they may be added if required.

[The parts on which the sowing action of the improved drop drill depends may also be readily added, and adapted to various cultivating implements and machines in ordinary use, such as cultivators, scarifiers, &c.]

The Sub-soil Pulverizer.

This improved sub-soil pulverizer may be employed either for stirring the surface of the soil, or for stirring both the surface and the sub-soil at the same time. A perspective view

of this implement is given in fig. 11: A is the beam, B a front coulter, or tine, which is provided with a cutting edge at front from *a* to *b* and terminates in a chisel point at the lower end. C C are other similar coulters, or tines, which are attached to a slotted bar or guide D, which is attached to the beam and the lower end of the handles, E E, by means of an iron clip F, which admits of the slotted bar or guide being raised or lowered to any suitable height according as it is desired to make them enter to a greater or less depth, whereby a free passage is left for the uprooted weeds and the working of the implement does not become impeded. The guide wheel G, also admits of a similar adjustment of height. The whole of the tines may be set to enter the same depth into the earth or the two hinder ones may be set deeper and stir and pulverize the sub-soil along with the surface soil.

The implement just described may also be employed for hoeing purposes for earthing up potatoes, or as a seed sower and manure distributor; when used for hoeing, the coulters are armed with moveable shares, such as represented in fig. 12, and when for earthing up potatoes the two hinder tines are removed, and a double share of the description represented in fig. 13, is attached to the slotted bar D.

Fig. 14 is a side elevation of a tine, and fig. 15 a plan of a hoeing share, showing a method of connecting the two together, so that they may present little or no obstacle to the instrument in passing through the ground. A is a slot, formed in the sole of the tine, into which the fore part *x x* of the share is inserted. The share is made slightly concave, and fixed with the convex side uppermost. The tine also is curved, so that the heel B and front C shall be on a level, or nearly so.

For sowing seed, or for distributing manure, either of the implements represented in figs. 1 and 7, after having their handles removed, may be attached to the slotted guide bar D (fig. 11), in which case they would form a horse implement for sowing or for manuring, or for performing both operations simultaneously. If the seeds are to be drilled into the ground, the coulters for drawing the furrows are affixed to the slotted guide bar.

IRON STEAM BOILERS, *versus* COPPER BOILERS.

(From an American Correspondent.)

It has been for many years, and still is, the practice of scientific men, to recommend copper in preference to wrought iron, for boilers to heat water or other fluids, on the ground of the superior conducting power of the former over the latter metal; and it will doubtless appear strange to many, that a doctrine so generally received should now, for the first time (known to the writer), meet with the most unqualified dissent. The superior conducting power of copper over iron admits of no doubt, and yet, upon this confessedly correct basis, has been raised the most fallacious doctrine which the whole range of scientific engineering of the present age can produce. It is scarcely possible to imagine the enormous amount of money wasted, and worse than wasted, in this country alone, by the use of copper instead of iron in the boilers of steam boats, to say nothing of locomotives. Four boilers were recently put into an United States steamer, which cost 120,000 dollars, and weighed 140 tons, while iron ones, according to Professor Renwick, would have cost only 34,000 dollars, and have weighed only 82 tons; thus, in addition to the 86,000 dollars useless first cost, there is an useless weight of 58 tons also.

That such an enormous outlay should be sanctioned may well excite surprise, founded, as it is, upon an engineering blunder, did we not remember another which kept its ground for some time in England, the much valued invention of Blenkinsop, in the early days of railroad engineering.*

In the case with these and many other boilers (more particularly Government ones), the heaviest, dearest, and weakest material is employed, for reasons, which, sooner or later, must appear too childish to be entitled to notice.

The experiments which have been made, proving that copper is a better conductor of heat than iron, are principally those of M. Biot, and M. Despretz. On a bar of each metal being plunged into a bath of mercury or of molten lead, it was found that although the temperature of each was of course almost,

* This invention consisted in placing cogs upon the rails and wheels, to get a foot-hold, as it were, having first assumed that the "bite" would not be sufficient to prevent the wheels going round without moving the carriage forward.

if not absolutely identical, at the smallest appreciable distance from the bath, yet the copper, being the best conductor of heat, kept it to itself, or would not readily part with it, while the iron was an inferior one in conducting power, in consequence of parting with it more rapidly. The term "good conductor" has therefore been applied erroneously, because it was intended to convey the idea that it would convey or conduct the heat or caloric of the fire, through itself, into the water on the other side—which does not apply to copper but to iron; which is confirmed by the facts which are well known, *that the absorbent and radiative powers are always equal in the same metal*, and are far greater in iron than in copper, while the latter metal is in the same ratio the best reflector; for, *reflection is inversely as radiation*, as proved by Leslie and others. The power of reflection then, appears to control that of radiation, &c., to confine the caloric within the metallic (copper) surfaces, or at least within that depth in which the power of reflection lies.

With these facts before us, together with others proving beyond a doubt that all other things being the same, more water is evaporated in the same space of time in iron than in copper boilers, with the same amount of fuel: it is not possible that the present absurd and fallacious arguments can stand another year; and their downfall must be hailed with pleasure by all who love the truth and progress of science, and will inevitably lead to the perfecting of boilers, made of that still *most noble* of all the metals, *iron—glorious iron.*

Copper being a better reflector than iron, is then, in consequence, inferior as an absorber of caloric, and for the same reason also as a radiator, but superior as a conductor, that is, as a retainer; for it appears that it is difficult for the caloric to get into copper (as compared with iron), and equally difficult to get out of it again when it has once got in, and therefore it expands within it, so that in a locomotive boiler, with copper tubes of a moderate length, the end of the tubes next the smoke-box, may be conveying away the heat from the end next the furnace,—a state of things which it behoves our railway engineers and directors to look after, as one of the elements of extravagance, in that most economical boiler.

Iron absorbs heat so much more rapidly than copper, that many explosions have occurred which would not, had copper been used; although this is admitted, it is a little too bad to praise copper for this also, that it will not let a boiler blow up, when everything considered, it ought to blow up, if a good fire and a good medium through which to convey its caloric into the water have any virtue in them. Copper cannot be a good medium through which to raise steam and a bad one to blow up with; that is rather too much, yet the argument means this if anything; nevertheless, it is admitted that this is not the ground on which any dependence can be placed, because, whenever such a catastrophe has happened it has arisen from a defective arrangement of the boiler—in fact the *greatest defect* that can properly occur in the designing of a boiler—the want of *complete and thorough circulation of the water within it*—on precisely the same principle as the circulation of hot water in pipes, for the purpose of warming buildings. No boiler of such a construction as here recommended ever blew up from the cause alluded to, as it is well known that water is a far better conductor of caloric than any metal, in the proportion (according to the experiments of Mr. Parkes of England), of above 26 to 10.

T. A. R.

New York, July 2, 1849.

THE TEREDO NAVALIS.

It appears from Mr. Paton's observations respecting the teredo navalis and other sea worms, that their ravages are not prevented by impregnating wood with poisonous solutions,—that they *feed* on wood, woody fibre having been discovered in the body of the teredo; and he concludes that small quantities of poisons do not affect them.

In Sir Samuel Bentham's "Naval Papers," No. VI., page 18, it is said—"I have understood that impregnation with *oil* has been used with good effect for the preservation of wood against decay, as well as against the destructive action of the sea worm; and some experiments I made at Plymouth Dockyard many years ago, gave reason to expect that this mode would be advantageous."

Not any note remains of those experi-

ments amongst Sir Samuel's papers; but the manner in which they were made, at his desire, by Mr. Jenner, of Plymouth Dockyard, was as follows:—Several pieces of wood, similar in kind and size, were taken to be experimented on; half the number of them were impregnated with common cheap oil, the other half left in their natural state; the whole of them were sunk, close by one another, in a pool of water where the sea-worm was known to commit its ravages; the experimental pieces of wood, after having been immersed in the sea water for a considerable length of time, were taken up, when the *unprepared* wood was found to be very much worm-eaten, but the pieces impregnated with oil were untouched, and in every respect sound.

If the different sea-worms feed upon wood, may it not be possible that, although mineral poisons do not injure them, yet that it may be either distasteful to their palates, or may be incompatible with their means of comminuting wood so as to prepare it for their food?

Might it not be worth repeating Sir Samuel's experiments, by impregnating wood with different kinds of low-priced oils?—train oil, for instance, coal tar, &c.?

A gentleman, who made numerous observations respecting the different sea worms at Sheerness, found that piles and woodwork there that had been paid with coal tar, in a great degree resisted their destructive attacks.

M. S. B.

MARINE PROPULSION—MACINTOSH'S SUBSTITUTE FOR THE SCREW.

A few days ago we had the opportunity of inspecting, at Messrs. Johnson, Cammell, and Co.'s Cyclops Steel Works, a remarkable improvement effected in the machinery for propelling steam vessels. It is the invention of Mr. Macintosh, and is manufactured at the Cyclops Steel Works. The propellers hitherto in use have been invariably made from cast metal, and when at rest or in motion are a perfect screw, *always* at the *same* pitch. The improved flexible propeller (Macintosh's) to which we refer, is made of steel well hammered and tempered, and set at an angle on the revolving shaft. When at rest it is a perfect plane, but when in action it forms a screw, and, by the flexibility of the steel, assumes a finer or a coarser pitch according to the strength of the adverse action of the water through which it moves. This circumstance imparts to the vessel and machinery an easy action, especially in rough and heavy seas, which has never been attained by the rigid screws now in use. Propellers manufactured according to this patent are not more than half the weight of those made of cast metal, though the forgings are the largest yet attempted to be made from steel. It has been ascertained by experiment that, in point of speed, there is a gain of at least 20 per cent. In heavy seas or rough weather this propeller can be easily hoisted on board by means of a simple block and tackle, thus saving the expense of the machinery now used for raising the cast metal ones; and, from bring malleable and tough, does away with the risk of breakage which necessarily ensues in the moving of a cumbersome piece of cast metal. In cost there is a saving of about 50 per cent. This is considered to be one of the greatest improvements yet made in marine propulsion. Several of these propellers have already been manufactured, and the Lords of the Admiralty have ordered a trial to be made on the *Bee* government vessel at Portsmouth.—*Sheffield Times.*

ELECTRO-MAGNETIC ENGINES.

The notion of obtaining an effective motive power from electro-magnetism is still so great a favourite among ingenious speculators, that too much publicity cannot be given to the following statements and calculations on the subject by Mr. Robert Hunt, the Keeper of Mining Records in the Museum of Economic Geology. They are extracted from a lecture recently delivered by Mr. Hunt before the Society of Arts:—

The author lays it down as a fixed law, whether in reference to the electric light, heat, or motive force, *that for any given result produced, a given quantity of some material must be consumed in the battery.* As it is necessary to burn a certain quantity of coal to produce the required horse power in a steam engine, so is it necessary to effect a similar change in a certain quantity of the elements of a voltaic battery to produce any given electro-magnetic force. The result of many hundreds of experiments, deduced in all cases from magnetic arrangements, giving the maximum effect, with the least consumption of material, was as follows:—

A grain of zinc consumed in the battery induced an electro-magnetic force capable of lifting 80 lbs. 1 foot high; whereas, in

the boilers of the Cornish steam engine, 1 grain of coal produced steam power capable of lifting 143 lbs. through the same space.

The electro-magnetic force can be produced with the greatest economy in those batteries where the chemical excitement is the greatest. One horse power is obtained in an electro-magnetic engine of any given construction at the cost relatively of 45 lbs. of zinc in a Grove's battery, and of 75 lbs. of zinc in a Daniell's battery—showing that a great mistake is made in endeavouring to obtain slowly-acting, *i. e.*, constant batteries, as they are called—to work electro-magnetic engines.

The action of electro-magnetism *through space* is next discussed by Mr. Hunt, and the results deduced by him, from many hundreds of experiments, are as follows:

The armature being in the first place brought into contact with the magnet, was fixed to one end of a beam, and the weights in the opposite scale necessary to remove the armature was the measure of the force exerted. By an easy adjustment, the contact of the magnet was afterwards prevented, and the force exerted was weighed off in the same way. By this it will be seen that the attractive force of an electro-magnet diminishes with the distance with astonishing rapidity:—

Contact.	1-250th of an inch.	1-125th ditto.	1-84th ditto.	1-62nd ditto.	1-50th ditto.	1-35th ditto.	1-25th ditto.
18	13	11	7⅓	7⅓	6¾	5	5
26	12	10⅓	—	6¾	—	—	—
40	23⅓	20	14	12	9	—	—
22	10	9⅓	5¾	5¼	4⅓	4¼	4
14	8	7 1-10	6	5 1-5	4	3⅓	—
100	64	50	34	30	25	—	—
98	62	49	32	28	21¾	20	20
300	175⅓	129	110	84	63	51	50
320	178	132	111¼	86	64	50	50
150	84	63¼	—	50	35	25	24
120	65	49	35	26	20	17	14
220	90	50	47	40	36	—	—

The results of experiments made with one of Mr. Hjorth's engines, and furnished by that gentleman, were as follows:—

Distance of piston from cylinder, in inches.	Attractive force in lbs. avoirdupois.	Angle of direction of magnetic force with the face of cylinder.
1	160	42° 34′
1½	140	50° 12′
2½	124	60° 57′
3	88	67° 22′
4	80	72° 39′
5	72	75° 58′

In this it will be seen that the force is measured at the distance of an inch in the first place, whereas, by reference to Mr. Hunt's Table, it will be seen that the great loss of power is at distances under the 1-25th of an inch. Mr. Hunt next draws attention to the results obtained by Dr. Scoresby and Mr. Joule, which were as follows:—

	Rate of revolution of magnet per minute.	Force of Current.	Zinc destroyed per hour, in grains.	Pounds lifted 1 foot high per hour.
Hot Solution.	140	920	205	21,100
	180	850	190	17,820
	80	850	190	8,800
	102	670	151	9,000
	114	13300	291	10,030
	122	10000	223	12,672

In the investigations which Mr. Hunt has made, he has proved that the moment a magnet is set in motion it loses power, and he gives the following as the means of many experiments showing this loss:—

Force of Current Magnet at rest.	Force of Current Magnet in motion.
2232	920
2232	850
1381	850
3381	678
2081	1300
2035	1000

Whenever any magnetic body is made to move in front of a magnet, the magnet immediately loses attractive force; the mean of a great many experiments being as follows:—

Attractive Force of Magnets.

At rest. lbs.	In motion. lbs.
150	75
143	70
120	68
75	31
30	14
15	10

In conclusion, Mr. Hunt contends that with any form of voltaic battery now known, the application of electro-magnetism, as a motive power, is almost hopeless within any moderate limits of expense.

A grain of zinc produces, on the best form of electro-magnet, a force equal to lifting a weight of 80 lbs. 1 foot high; but as this power diminishes so rapidly through space, and as it again diminished the moment motion is established, the highest power it is capable of exerting in practice is 40 lbs., whereas a grain of coal exerts a power equal to 143 lbs. Zinc costs 216d. per cwt., coal less than 9d.—therefore the cost of working a magnetic engine would, under any conditions now known, be very much more than one hundred times more expensive than the cost of working a steam-engine.

SCREW PROPELLING.

To Engineers, Ship-owners, and all Persons Interested in the Screw Propeller.

Whereas, there has been much conflicting evidence, and great deception practised in endeavouring to prove who is the just and rightful claimant for the screw propeller, it is only right and proper, for the sake of truth and justice, that the following information should be made known:

The jury in each trial have not been able to elicit justice, in consequence of not having heard the evidence of Mr. Taylor, who was the partner of the late Mr. Edward Shorter; also of Captain E. I. Carpenter, R.N., who made important experiments with Shorter's propeller, with a view of bringing the invention into use in all its various applications and adaptations.

It was not made known to the jurors, by some strange oversight, that Mr. Taylor was, at the time the trials were going on, in possession of Shorter's original models and drawings, which clearly prove that Mr. Shorter was the inventor and owner of the "propeller," and not Mr. Smith or Mr. Lowe, whose claims have been contested in two or more trials.

Mr. Taylor has a small model, which formerly was the property of the late Mr. Edward Shorter, which was exhibited before Sir Robert Seppings, Surveyor of the Navy, in the year 1830, by him, at Somerset House. This model fully demonstrates the invention as claimed by Mr. Lowe.—The shaft lies in a line with the keel, passing through the vessel below the water line, having a propeller with two vanes attached to it, working between a rudder-post and stern-post. Mr. Taylor is also in possession of his curved vane propeller, a section of a screw which was applied to his models: it corresponds precisely with Lowe's description of the propeller, as it is given in his specification, though unlike that which is represented by the drawing attached to it.

Captain Carpenter is also in possession of one of Shorter's original curved vaned propellers, which, when placed side by side of Lowe's original propeller, and compared with his specification, would convince any intelligent jury that the invention was Shorter's, and not Lowe's.

The original drawings show that Shorter used his patent propeller over the bows by outriggers, which Lowe has had the audacity to state in his patent, "failed," which is not the fact, as it can be proved from certificates, letters, and documents, transmitted to Mr. Shorter from Admiral Bickerton, and other naval officers, who witnessed his experiments in the year 1802, that he was successful in propelling ships at a satisfactory speed, so far as that portion of his invention was concerned.

Witnesses of the highest respectability can be brought forward to prove that these models and drawings were publicly exhibited before the 24th of September, 1838, the date on which Lowe's specification was enrolled. Therefore, as Lord Denman stated before a jury in a trial, Lowe *v.* Penn, in the Court of Queen's Bench, February 25th, 1841, "That if this invention had been used before, or specifically described before, so that the instrument could be made from the description of it, then the party claiming could not be called the inventor, or be entitled to a patent." As it can be proved,

on undoubted authority, that the invention has been so clearly explained and described by Mr. Taylor and Captain Carpenter, at 51, Gracechurch-street, City, on the models above stated, that any ordinary engineer could have made the "Propeller," and have fitted a steam vessel with it from the description they gave of it before Lowe's specification was enrolled, it is clear that the advantages arising from the invention belong to Shorter, or his heirs and successors, and to those persons whose industry caused it to be noticed by the public.

It is therefore highly desirable that there should be another trial, in order that the rightful owner may be ascertained, so that engineers and persons interested in the propeller may not have to pay for the right of patent of an invention which belongs to the public, that justice may be done to all persons interested in the invention, that the propeller may carry with it a truthful history to posterity, instead of a false character, in which light it now stands before the world.

Engineers making an extra charge to persons for the propeller, in consequence of the patent right, must see the necessity of having another trial, as it is a charge which would always be liable to be disputed on the grounds of injustice, so long as the patent right appears to be held by persons not justly entitled to it.

From your most obedient and humble Servant,

J. J. O. Taylor,

Patentee of the mode of shipping and unshipping the Propeller in-board through a well-hole or trunk.

N.B. Mr. Lowe was an apprentice of Mr. Shorter's, and worked for him as a journeyman for years, and until within a few days of his death, which took place February 4th, 1836, aged 76 years.

50, Gracechurch-street, City, July 3rd, 1850.

FLOATING CAISSON GATE AT PLYMOUTH DOCKYARD.

We gave some time ago (vol. xlix., p. 441) a description of the floating caisson gate designed by Sir Samuel Bentham for the Great Basin at Portsmouth, and erected under his immediate superintendence. A similar work has just been completed for the new works at Keyham (connected with the Plymouth Yard), by Messrs. William Fairbairn and Sons, of Manchester. We extract the following account of it from a local paper:

The caisson is a huge hollow iron box of the form of the entrance to the lock, perfectly flat at the sides, 82 feet 6 inches long at the top, only 13 feet 6 inches wide, and of the enormous depth or height of 42 feet. The lower part of this box is formed into an air chamber, or what may be termed the lungs of the caisson, by a strong iron deck which is carried from side to side at a height of about 12 feet from the bottom, and made perfectly air-tight. The capacity of this air chamber is so adjusted that when the caisson is immersed in water, the confined air exerts a buoyancy a little in excess of the total weight of the caisson; and as by means of sluice valves the water is allowed to enter the inside of the caisson and fill it from the top deck of the air chamber upwards to the level of the water outside, whatever that may be, it follows that at any point of the tide, and with any depth of water greater than that which would float it, the caisson would swim a few inches clear of the masonry. The total depth of the caisson is about 5 feet greater than the depth of the water at the entrance to the lock at high spring tide, and this space is made available for the means employed for sinking and moving the caisson. A water-tight tank is formed in this part of the caisson capable of holding 60 to 70 tons of water supplied to it from the water-main of the dockyard; and it depends upon the presence or absence of this quantity of water in the upper tank whether the caisson remains firmly resting on the masonry and closing completely the entrance to the lock, or floats a few inches clear of the floor ready to be hauled by capstans into the recess in the earthwork which has been prepared.

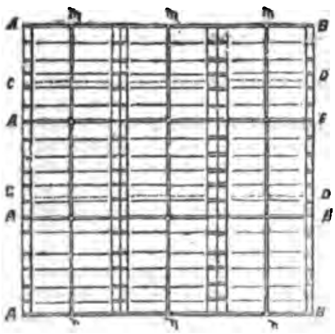
The ingenious manner in which the buoyant principle is taken advantage of constitutes the most meritorious feature of this scheme, for the emission of the small quantity of water confined in the top tank (which, by means of an ordinary valve placed in its bottom, is accomplished in about two minutes) dispenses with the laborious and expensive process of pumping, which has usually to be resorted to.

IMPROVED PLAN OF CONSTRUCTING TEMPORARY BUILDINGS OF LARGE AREA.

BY W. R. THOMPSON, ESQ., C.E.

The plan of construction about to be described was originally designed for the great building to be erected in Hyde Park for the Exhibition of 1851, but not formally submitted to the Commissioners intrusted with the management of that undertaking (though mentioned privately to some of its members); and it is now published from an impression that it may be found advantageous in other cases where a large space is required to be covered in, for some temporary purpose, free from any obstruction to sight, or communication from interior division walls, or roof ties and trussing. A building on this plan does not aspire to the character of being "fire-proof;" and its designer must confess that he is at loss to discover the wisdom of promising the world that the building for the forthcoming Exhibition shall be perfectly safe from fire, when for ten times less than the sum it will take to erect such a fire-proof structure, any fire-office in town would insure the entire affair—building, goods, and all. But he confidently submits it to the judgment of his professional brethren as

Fig. 1.



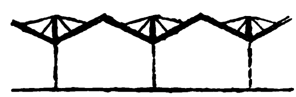


Fig. 2.

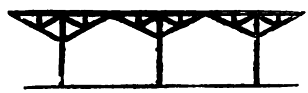


Fig. 3.

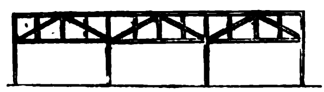


Fig. 4.

superior to anything yet proposed for simplicity and cheapness, for the ease and rapidity with which it may be put up and removed, and for its general sightliness and perfect efficiency. The Commissioners are said to have adopted the glass-house plan of Mr. Paxton, but (to say nothing of other objections) that will cost at least three times the money.*

The novelty of the present plan of construction consists in placing all the work supporting the roof on the outside between the parallel lines of roof. Some idea of its appearance may be obtained by supposing a number of railway station roofs placed side by side, and then turned upside down, so as to bring the whole of the ties, &c., to the outside. Fig. 1 represents a plan of a portion of the roof; fig. 4 is a section on the line E F, showing the trussed girder or joist, on the lower part of which the couples of the roof abut, and from the upper part of which they are tied, as shown in fig. 3. Fig. 2 shows the timber couples which connect the iron side columns (proposed to be placed forty feet apart) trans-

* Mr. Paxton's *contract* price is stated to be 85,000*l*. Extra work to be charged for as usual; and *as usual* this will very likely double the amount.

versely across the ridges of the roofs. The couples shown in fig. 3, and the trussed girder in fig. 4, run in right angles to each other, and impart to the roof a stability not possessed by roofs of the common construction. This stability is quite independent of the walls, or of the fixing of the columns at the bottom. The columns pass up through the roof to the level of the top of the trussed girder fig. 4; and every column is so worked into the framework of the roof that it cannot have the least lateral motion. This roof would have the same kind of stability as that possessed by a table—the legs corresponding to the columns. In all common roofs the walls have to bear the lateral strain—not the thrust of the couples, but the side thrust produced by the wind; and it will be granted that walls capable of sustaining so large a roof so large as that required for the exhibition will require to be exceedingly massive. In the present roof the walls are not called on to do any work of the kind—the roof would stand, as it were, on its own feet.

Another advantage of the new roof is, that it presents a fine vaulted appearance, perfectly free from all beams, joints, and ties.

The designer proposed to cover his roof with sheet lead, as the cheapest temporary covering. The cost of the sheet lead necessary to cover such a building would be about 20,000*l.*; but then it would produce, for re-melting, at least 17,500*l.* Zinc would cost about 10,000*l.*; but its value, as old metal, would not pay the additional labour of laying it down and taking it up.

R. W. T.

July 17, 1850.

ON THE COMPARATIVE MERITS OF IRON AND WOOD FOR SHIP-BUILDING. BY EDWIN O. TREGELLES, ESQ., C.E.*

The subject of building iron vessels, is one that may well claim the attention of all who are interested in the prosperity of Great Britain.

Success in this branch of our industry, may be regarded as one of the means, by which we may avert the consequences of the alterations in our Navigation Laws,—dreaded by many as calamities: and by which we may maintain that pre-eminence in the commercial world, that has been so long enjoyed.

It is probable that Great Britain cannot compete with many other portions of the globe, in the construction of low-priced wooden vessels, and that ere long our shipwright's yards, will be merely places for repairing damaged vessels, rather than for building new ones; whereas, if we bend our energies to the successful application of iron for the purposes of ship-building, it is likely that we should command the market in ship-building, and possess a commercial fleet of the highest order.

Let us assume that there are no prejudices to overcome; and no objections, real or imaginary, to be removed, and coolly consider the relative benefits that may accrue from the employment of the respective materials. We will consider the advantage to the State, of using the one or the other.

In the building of a first-class oak ship, of 500 tons, we shall require about 700 tons of timber in the rough. That timber occupied 12 acres of land, on an average 75 years, and is worth more than 1,200*l.* as it stands, growing, before any labour of an artizan has been bestowed on it; or in other words 1,200*l.* is the value of the *raw material*, before it is manufactured. The hull, when finished for launching, will be worth 6,000*l.*; the value of the raw material being one-fifth, or 1,200*l.*; and of labour and profits, four-fifths, or 4,800*l.* The value of the raw material for an iron ship of the same size would be about 50*l.*,—being the royalty paid to the owner of the soil for the liberty to work the iron ore, limestone, and coal; the labour and profit would be nearly 6,000*l.*, say 5,950*l*; and we shall then have an iron ship costing 6,000*l.*—of which the raw material costs less than half per cent.

Some persons may estimate the value of iron and oak vessels at less, or at more, than the foregoing figures, which may not be the exact value of the respective classes, but they are sufficiently near the truth to exemplify the real facts.

We have then a vessel of 500 tons costing 6,000*l.*, whether of wood or iron. The oak vessel would not last, on the average, more than 15 years, and would require to be repaired in that time probably five times, at an expense of say 300*l.* each time, or a total of 1,500*l.*, and this may be regarded as a very moderate computation, but it would increase the cost of the oak ship to 7,500*l.*, which, if sold for old timber at the end, would fetch 250*l.*, leaving 7,250*l.* to be divided over fifteen years, and we shall have 473*l.* as the annual cost of the oak ship of 500 tons, exclusive of interest or capital. We will compare this with the iron vessel

* From the last Annual Report of the Royal Cornwall Polytechnic Society.

of the same size costing 6,000*l.*; which, on the average, may be fairly estimated to last twenty years: and may require in that time to be repaired ten times, at an expense of 100*l.* each time, making the first cost and repairs 7,000*l.*; the value of the old iron ship at the end of twenty years, may be estimated at 600*l.*, giving us 6,400*l.* to be divided by twenty years, and we shall have 320*l.*, as the annual cost of an iron vessel of 500 tons, exclusive of interest or capital: therefore we see that the cost to this country of using oak vessels, may be expressed by the figures 473, and the cost of using iron vessels by the figures, 320, or if we allow for errors in the attempt to form an accurate approximation, we have still a great advantage in favour of iron if we place 4 at the figure 3, and express the oak vessel by 4.

But an iron vessel of 500 tons register, would carry 100 tons more than the oak vessel with the same displacement; nor is this all, the speed of the iron vessel would be much greater, and it will run 6 miles, whilst the oak goes 5½, or doing as much in eleven months, as the oak does in twelve, or earning 12*l.* whilst the oak vessel earns 11*l.* Again; in the time occupied in repairs, the iron ship would not be detained two weeks in the year on the average; whereas one month in each year must be allowed for the aggregate repairs of an oak ship, or 15 months out of the whole time; the money value of which is about 600*l.*; whilst the loss of time by the iron vessel would be only 40 weeks, or 10 months, the loss of time being equal to 266*l.* We have an advantage, then, of one-sixth as to stowage and one-twelfth as to speed, making a saving of one-fourth on 30*s.*, or reducing the cost of carrying by an iron vessel to 22*s.* 6*d.*, irrespective, of course, of the wages and victualling, which would be alike in each case, compared with 40*s.*, the cost of carrying by an oak vessel; besides this, we must estimate the saving in time for repairs, which we see is as 266*l.* for iron compared with 600*l.*, as the value of the time consumed in delay whilst repairing the oak vessel.

Then if we can carry for 22*s.* 6*d.* what has heretofore cost us 40*s.*, would not the adoption of iron vessels keep for us the advantageous position in commerce which we have long enjoyed?

But it may be argued that the premises are unsound, and therefore the conclusions are false;—that an iron vessel cannot be as safe as an oak one, and therefore never can succeed; in fact, after all, "there is nothing like oak!" Well, let us examine the subject in all the bearings within our reach, and perhaps we shall conclude that, after all, "there is nothing like *iron!*"

We shall find some excellent practical remarks by John Grantham, a Liverpool ship-builder; he says—

"What are the objects most desired by the merchant in the choice of a ship? these, I consider, are—

"1st. Strength, combined with lightness.

"2nd. Great capacity for stowage.

"3rd. Safety.

"4th. Speed.

"5th. Durability.

"6th. Economy in repairs.

"7th. Cost.

"8th. Draught of water.

"I trust I shall be enabled to prove that iron vessels possess advantages, under all these heads, in so eminent a degree as to render them superior to wooden vessels, and address myself to each point in its respective order:—

"1st. Strength, combined with lightness:

"This subject involves two considerations—the strength of the materials, and the mode of uniting them.

"The great strength of malleable iron to resist strains in every direction is well known, but to those who are not conversant with the subject, the extent to which this advantage may be carried out is not at first apparent, or how the material may, from comparatively small pieces, be so combined in large masses as to form the ponderous body of a ship; and they are thus too apt to prescribe a limit to its use. An opinion, indeed, is now very generally entertained that iron may be suitable for small craft, but is inadequate for the construction of vessels of heavy burthen; this, however, is a supposition so erroneaus, that the reverse would be much more correct; for large vessels will afford the best practical demonstration of the superiority of iron for ship-building. In the application of timber, obstructions increase in a ratio proportioned to the increased size of the vessel to be built. How often has the ship-builder the greatest difficulty in obtaining timber to suit the varied curves of our finest ships? How often is the country despoiled of its noblest ornaments by the tempting prices he is compelled to offer for its magnificent oaks? the largest of which are frequently insufficient for his purpose. How are his brains racked and his patience tried, in seeking for crooked timber necessary to frame a sharp floor, or square bilge! How often is he obliged, though he knows it to be injurious, to scarf the frames for which no timber can be found sufficiently large, to enable him to avoid such defects?—and is not this one cause, amongst others, why our building-yards are

empty, while our ports are filled with ships from other nations, in which timber is more plentiful, and the choice more extensive?

"But how stands the case when we turn to iron; where is the frame, even of the most intricate form, that our smiths cannot mould? Where the frame or beam so large that iron cannot be found of which to fashion it, and that too, if need be, without a scarf? Here there are no knots, no sap, no cutting across the grain. Here there is no useless timber, placed merely to fill in, or to cross butts. Here every inch of material is of service, and every scrap applied to some useful end.

"Iron has also to a high degree the power of resisting compression. Timber, it is admitted, has great power to resist tension in the direction of the grain, but is very deficient in strength across the grain; and its power to resist compression is also very limited, especially when it is exposed to moisture.

"Again; timber, after being some time in use, becomes brittle, and is but little disposed to bend.

"Good malleable iron, on the contrary, may be bent double, even when cold, and does not become brittle with age, except when converted into an oxide. The ease also with which iron beams and frames can be wrought, and the facility of obtaining them of any dimensions in one piece, overcomes one of the greatest difficulties in ship-building.

"I have before stated, that the power to increase the stiffness of the hull, when built of iron, is unlimited, and provided the shell has originally been made sufficiently thick, additional strength may at any time be given to the frame.

"The objections arising from the use of fastenings of a material so totally different from that of which the hull is composed, are entirely removed in iron vessels: in the first place, the outer shell of the vessel is composed of a series of plates, so riveted together that its strength is nearly equal to what it would be were it possible to form the whole of one plate; this shell is independent of all indirect means for preserving its completeness; it forms one grand whole, of the same material throughout, and that of the strongest kind. This shell is stiffened, as before described, by ribs crossing the joints of the plates at short distances apart, and giving an additional security. Beams, knees, bulkheads, all are brought together in one firm mass, and united by numberless short unyielding rivets. I may venture, indeed, to say, that more real serviceable fastening is often employed in the space of a few inches in an iron vessel than is in most instances brought to bear on one entire beam of a timber-built ship.

(*To be continued.*)

THE CYMAMETER.

Sir,—Seeing in this day's *Mech. Mag.*, a description of the above invention as registered by Mr. Fenn, I must request permission to claim the bantling as my own—a bantling by-the-bye, now just twenty-five years old, but one of which I have no just cause to be ashamed.

Such of your readers as have access to your early volumes, may see at page 94 of vol V., a very accurate description of this invention, being an improvement upon a plan, emanating in the first instance from another correspondent.

I remain, Sir, yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington, July 13, 1850.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING JULY 18, 1850.

RICHARD SMITH, Clitheroe, Lancaster, manufacturer. *For certain improvements in looms for weaving.* Patent dated January 17, 1850.

The improvements comprehended in the specification of this patent are as follow:—

1. Two drums or pulleys are keyed on the axles of the driving and tappet shafts of the loom, which are placed in the same vertical right line, and between them there is a wedge-formed break, supported at one end of a horizontal rod, which is connected to a lever that oscillates on a pin fixed to the side of the frame. The surfaces of the wedge are coated with leather or other suitable substance. This lever is in communication with the weft detector and stop-piece through the intervention of certain mechanical arrangements, so that, when occasion requires, the wedge break is forced in between the drums, and made to bear against their peripheries. At the same time the driving shaft is shifted from the fast to the loose pulley. The reverse motion of the spring lever, when the loom is to be set to work, liberates the drums by allowing a spiral spring, which is attached at one end to the break and at the other to the frame, to act upon the break, and draw it back.

2. The batten carries a horizontal rod, which is fitted at each end with a lever, the top of which is curved so that it may take into the race. Under the batten there is a spring, in order that as the former beats up, the pendant ends of the levers may come in contact with it and be forced outwards, while

the upper or bent ends will he forced forward into the race, and hold the shuttle to prevent its rebound. In front of the bent ends of the levers are springs which come in contact with the shuttle. When the lower ends have passed clear of the first-named spring, and the batten is brought back, then this reverse motion will cause the curved ends to take out of the race, and leave the shuttle free to receive the pick motion. When the shuttle misses boxing, the levers will enter farther into the race, and allow the rod to revolve. This rod carries the stop-piece, which will thereby be brought down, and as the batten beats up will come in contact with the stop.

Claims.—1. The use of a wedge-formed break capable of acting against the peripheries of two drums or pulleys—one keyed on the axle of the main shaft, and the other on the axis of the tappet shaft—such drums or pulleys being added to the loom for the purpose of being worked in conjunction with the wedge-formed break.

2. The use of a wedge-formed break capable of acting upon the peripheries of the drums or pulleys, placed on the driving side of the loom, and upon that side of the driving centres.

3. The use of a wedge-formed break constructed in two parts, which are capable of turning on a fixed centre, and of being brought into contact with the peripheries of the two drums or wheels by the action of levers or other mechanical arrangement.

4. The use of the projecting piece [connected to the oscillating lever], turning on its centre, capable of being acted on by the spring lever, whereby the drums will be liberated by the action of the spring thereon.

5. The application of the levers to the stop rod, capable of being so acted on as to prevent the rebound of the shuttle, but will allow it to enter without the opposition of springs or other mechanical contrivances, and remove the pressure from the shuttle when the picking motion is about to be made.

6. The application of the levers and springs to the stop rod for the purpose of working the stop piece.

MATTHEW URLWIN SEARS, Burton Crescent, St. Pancras, commission agent. *For an improved construction of guns and cannons, and manufacture of cartridges for the loading or charging the same.* Patent dated January 11, 1850.

The improvements which the patentee describes and claims are:—

1. Making the barrel of an enlarged bore well-bevelled edges at the breech end, and to screw into a short barrel which is fixed to the stock, and is provided with a longitudinal slot that terminates in an oblong opening of sufficient size to admit of the introduction of a cartridge. This short barrel is turned true inside to allow of what is termed the "sliding barrel" moving easily, but air-tight, within it. The sliding barrel is provided with a handle, whereby it may be made to open or close the charging chamber, and to lock, in the latter case. Its fore edges are bevelled off, so that when pushed up close to the breech end of the barrel it shall form a kind of valve with the latter. To insure the junction of the two ends being tight, a diaphragm of brass is interposed between them, behind which there is an "air-chamber," through which the needle guide passes. The air contained within the chamber prevents or diminishes, in consequence of its resiliency, the recoil of the gun; and its expansive force—increased by being heated, through the explosion of the cartridge—augments the force with which the bullet is expelled. The sliding barrel carries the needle guide, which projects through a diaphragm into the air-chamber and contains the needle-holder. A spiral spring, of a force of about 16 lbs., is coiled around the needle-holder, and tends to push it out. The spring holder is drawn back by means of a catch, having a handle projecting through the barrel, until a socket, fixed to the fore end, takes into a second catch or detent connected to the trigger. When it is desired to load the gun, the sliding barrel is unlocked and drawn back to open the charging chamber, the cartridge is placed in the barrel, the needle-holder being previously drawn back to the half or full cock. The sliding barrel is then pushed back into the first position and locked. To fire the piece the trigger is pulled to release the needle-holder, which is then pushed forward by the action of the spring, penetrates the powder, strikes against the percussion cap, and thereby explodes the cartridge. The patentee describes some modifications of these arrangements, and their application to cannons—the principal novelty in the latter being the employment of toothed gearing to effect the movement of the sliding barrel.

2. The cartridge is composed of a small cylinder of paper filled with gunpowder, and closed at the fore end by a disc of millboard. The percussion cap is fixed in the middle of this disc, in order that the needle may strike against it. The paper is coated on the outside with tallow or grease, and attached to the bullet by cotton threads. The bullet is made of the same diameter as the bore, and with two or three rings on its periphery to fit into the grooves inside the barrel, so as to cause it to turn on its axis, and to prevent the escape of any of the gases which may be evolved.

JOHN MILWAIN, Manchester, joiner. *For certain improvements applicable to the closing of doors, windows, and shutters* Patent dated January 12, 1850.

The object of this invention is to prevent the entrance of noise or dust into an apartment when the doors, windows or shutters are closed. The following are the arrangements proposed to be adopted for this purpose:—

1. To the bottom of the door there is attached a slip of brass, which carries two pieces of vulcanized India-rubber or gutta percha. These pieces are attached at bottom to another slip of brass which carries on the underside a strip of vulcanized India-rubber extending the whole length of the door. Between the two strips of brass there are two cams, turning freely on two pins, which are connected to a horizontal rod. The lower parts of the cams rest upon the top of the second brass plate, which carries underneath the long strip of India-rubber. The inner end of the rod bears against a set screw, let into the jamb, so that when the door is closed the rod will be pushed inwards, whereby the lower ends of the cams will be depressed, so as to force the brass plate downwards, and, also, the India-rubber into close contact with the floor. When the door is opened, the horizontal rod being withdrawn from contact with the end of the screw, the cams will no longer act upon the brass plate, and the resiliency of the two pieces of India-rubber will come into operation, which will have the effect of drawing back the second brass plate and the strip of India-rubber, which it carries, from contact with the floor. The set screw may be adjusted to any length in its bearing, so as to regulate the distance which the horizontal rod is pushed, and, through the intervention of the cams, the extent to which the strip of India-rubber is to be compressed. Instead of employing cams to depress the plate and strip of India-rubber, it is stated that the same result may be obtained by substituting for them two sets of toggle jointed levers in combination with the horizontal rod as before.

2. To close the joints of sash windows, Mr. Milwain employs a moveable plate of brass, which is fixed to the top rail of the lower sash, and carries on the outside surface a strip of vulcanized India-rubber, and on the inside two loops, the sides of which, opposite to the brass plate, incline inwards. Behind the brass plate there are two springs, which thrust it outwards, and a horizontal rod which slides to and fro in guides. This rod is fitted with two pins, which take into the loops. The sash frame on the side where the loops are deepest has a recess cut in it in such manner that the back, against which the end of the horizontal rod rests, inclines forward from the bottom upwards. By this arrangement it will be seen, that when the window is shut down, the springs will act against the brass plate and force the India-rubber into contact with the lower rail of the top sash. But when the window is to be opened by raising the lower sash, the end of the horizontal rod will slide along the inclined back of the recess, and be consequently moved inwards, which will cause the pins to move along the inside of the inclined backs of the loops, whereby the brass plate will be forced inwards, and the India-rubber withdrawn from contact with the lower rail. The arrangement just described is applicable to such windows only as are opened by raising the lower sash. In the case where both sashes are to slide up and down; then the inclined back of the recess is made moveable and keyed on a spindle (extending the breadth of the two sashes), the other end of which carries a strip of metal projecting upwards. The lower part of the style of the top sash, on this side is provided with an incline surface which, when it is pushed downwards, acts upon the metal strip projecting upwards, and forces it back, whereby the moveable back of the recess will be pushed forward, so as to cause the horizontal rod to move inwards, upon which the strip of India-rubber will be, as in the foregoing instance, withdrawn from contact with the lower rail of the top sash.

3. Instead of any of the preceding self-acting arrangements, the joints may be closed by a subsequent operation of the hand, by connecting the spindle of a knob or handle to the moveable brass plate. A male screw is cut on this spindle, which is made to take into a screw nut fixed in the frame, so that by turning the handle in one direction or the other, the brass plate will be moved inwards or outwards, and the strip of India-rubber brought into or withdrawn from contact accordingly.

4. To close the joints of French windows, the patentee proposes to attach to each of the styles a strip of India-rubber, extending from the top to the bottom, which, when they are closed, are compressed into grooves or recesses cut to receive them in the inside of the frame. The two half checks are each fitted at the outer end with two strips of metal extending from the top to the bottom, which inclose a strip of vulcanized India-rubber or gutta percha, which projects beyond them, so that when the window is closed the two strips of India-rubber abut against their opposite half checks, and are compressed between them and their respective cases.

Claims.—1. The use of moveable strips of India rubber or gutta percha applied to

the joints of windows, doors, or shutters for the purposes before set forth (preventing the entry of dust or noise into apartments), which are set in motion by closing the doors, shutters, or windows, or by a subsequent operation of the hand.

2. The mode of applying India-rubber or gutta percha to French windows, or other entrances, which open after the manner of what is termed folding doors for the purpose of closing the joints.

James McDonald, of Chester, coachmaker. *For certain improvements in the mode of applying oil or grease to wheels and axles, and to machinery, and in connecting the springs of wheel carriages with the axles or axle boxes.* January 11, 1850.

Claims.—1. An air-tight oil box, in which the oil is supplied to the journals by means of a wick, and certain arrangements for keeping out dust and collecting the surplus oil.

2. Constructing and connecting the springs and axle boxes of railway carriages and wagons in such a manner that the springs and carriages may have a small amount of motion independent of the axle boxes without straining the springs or axles.

John Fayrer, Surrey-street, Strand, Commander in Her Majesty's Navy. *For improvements in steering apparatus.* Patent dated January 11, 1850.

The novelty of Captain Fayrer's steering apparatus consists in the application of a break to a pulley keyed on the axle of the steering wheel for the purpose of arresting the motion of the rudder when required. The break is composed of a band of metal which is lined with a number of pieces of wood, and nearly encircles the pulley. One end of the break is made fast to some suitable fixture in the deck underneath the pulley. The other end is connected by an adjustable screw point to one end of a lever on which the steersman treads when desired, so as to cause the pieces of wood, inside the break, to come into forcible contact with the circumference of the pulley, and to prevent or retard its further revolution, whereby the rudder will be retained in position. The break may be connected to a lever on either side of the wheel, so that when there are two men at the wheel they may both be able to act upon it. When not in use, the break is kept off the pulley by the action of a weight suspended to one of the levers.

Claim.—The so arranging of apparatus in combination with a steering wheel, that the steersman may, by his foot, bring a break into action, to retain or aid in retaining the rudder in any position into which it may be brought by the steering wheel.

Bennett Alfred Burton, of the firm of Bennett, Burton, and Burton, of John's-place, Holland-street, Southwark, engineer. *For certain improvements in apparatus connected with sewers, drains, and cesspools; also in suction and delivery pipes, and in connecting such pipes or hose; the apparatus connected with sewers, drains, and cesspools being applicable to other like purposes.* Patent dated January 11, 1850.

1. Mr. Burton's improvements in so far as they relate to sewers, consist of a self-acting sewer flushing apparatus. In the side wall of the sewer there is a pin, on which turns loosely a short lever, heavier at one end than the other. The light end of the lever is carried downwards, and bears against a projection on the flush-gate, so that when the latter is closed it will keep it so against the pressure of the accumulating water on the other side. The weighted end of the short lever takes into a slot cut in the lower end of a vertical rod, which is attached at top to one end of a horizontal lever that oscillates freely on a pin in the side wall of the sewer. The other end of the horizontal lever carries a rod which is provided with a float at bottom. This rod and float are suspended in a well, built in the side wall, which communicates at bottom with the sewer on the side where the water accumulates. Supposing the flush-gate to be closed, and kept so by the short lever, then the water will gradually rise in the sewer and in the side well, elevate the float, and depress the slotted rod at the other end of the horizontal lever, until the top of the slot comes in contact with the weighted end of the lever and depresses it, thereby lifting up the other end out of the way of the flush-gate, which will then be suddenly forced back by the pressure of the accumulated water, on which the flushing will take place. The orifice at the bottom of the well is made of such size that the sewer shall be emptied before it, in order that the flush-gate may close, as it would do, from the manner in which it is hung, when no longer forced back by the pressure of the running water, before the short lever is brought into the first position by the descent of the float in the well.

2. A self-acting apparatus for flushing gulleys, is described, which consists of a reservoir fixed above a drain, and closed by a trap door which has a tendency to do so, and remain in a horizontal position through the action of a weighted lever affixed to that side of it where it is hinged to the side of the wall of the reservoir. The opposite side of the trap door is provided on the top face with a staple, into which takes a catch attached to a weighted lever, whereby the trap door will be maintained in a horizontal position, so as to close the reservoir until the catch is withdrawn from the staple by

the accumulation of water in a well which communicates at bottom with the reservoir, and contains a float. This float is fixed on the top of a vertical rod, which as it is drawn upwards by the rising of the float, gradually lifts up the light end of the catch lever, in consequence of this latter taking into a slot cut in the lower part of it, whereby the catch will be withdrawn from the staple, and the trap door will suddenly fall down and allow the superincumbent water to flush the drain. The orifice in the well is contracted, in order that the reservoir may be emptied before it, and the trap door brought into a horizontal position before the float descends, which when it does so, will cause the catch to take into the staple as at first starting. The service pipe opens into the reservoir.

3. To effect the intermittent flushing of house drains by the overflowing of the cistern, the patentee proposes to adapt to the top of the drain two branch pipes, which communicate respectively, by means of valves, with two cisterns, or with each half of a cistern divided into two. Each valve is connected by a chain to either end of a horizontal lever, which oscillates freely on a pin between the two cisterns, and carries at its centre a slotted rod, into which takes a pin on the side of a shoot under the overflow pipe. The top of the slotted rod is weighted, in order that it may act as a tumbler; and each end of the lever is provided with a ball or float. As one cistern is filled, the ball will gradually rise until its valve is opened, and the slotted rod is brought beyond the perpendicular, when the weight at top will cause it to fall on the other side, and reverse the position of the shoot so as to convey the water into what was previously the empty cistern. Instead of the shoot in the preceding arrangements, the outlet of the overflow pipe may be fitted with a curved pipe having two outlets, and provided at its point of junction with a two-way cock, the spindle of which is connected to the tumbler, which will, as it is moved from one side to the other, change the position of the cock, and cause the water to flow into either cistern alternately. Or, the outlet of the overflow pipe may be provided with a flexible pipe, which will be shifted from one cistern to the other as the tumbler falls to one side or other. Or, the cistern may have a knife edge extending all along its under surface, on which it oscillates. The overflow pipe opens over the centre between the two cisterns, each of which is provided with a recess in the upper part of opposite sides, so that when one cistern is full, the water will rise in the recess of that cistern, and suddenly tilt it over on that side, whereby the spindle of its valve will come into contact with a pin projecting from the branch pipe of the drain on that side, which will force it upwards, and thereby open communication between the two. The water will then flow into the empty cistern until the same operation is repeated on this side.

4. The patentee proposes to close pipes, employed to convey matters from cesspools, &c., which are composed of vulcanized India-rubber, by riveting thereto four metal plates, with spaces between them. Two of these being opposite ones, are fitted with arms which project in reverse directions. When it is required to close the tube, the two armed plates are pressed against the other two, whereby it will be nipped, as it were, between them.

5. Instead of using tubes of leather, vulcanized India-rubber, or gutta percha, Mr. Burton employs tubes of thin sheet iron, which he renders partly flexible by making them in lengths, and connecting these together, with spaces between each two, by enclosing the joints in short tubes of greater diameter than the others. A short piece of India-rubber tubing encloses the whole, and is made fast at each end to one of the iron tubes by wire or otherwise. When it is desired to unite two flanged tubes, one of them is provided with four levers, the heels of which are caused to press the flange of the second against that of the first by slipping a triangular ring over them. Or, two pipes may be united by attaching to one of them, by means of a piece of India-rubber tubing, a short length of pipe, which forms with the other a bayonet joint.

6. An apparatus, is described, for emptying cesspools without allowing any of the noxious vapours to escape into the atmosphere, which consists of a framework mounted on wheels, in order that it may be easily moved from place to place. It carries a cylinder, about thirty-six inches in diameter, which is provided with a tap at bottom to admit of a pipe being adapted thereto when required. The cylinder is furnished with a piston, packed air-tight, which carries a toothed rack. The frame carries a spindle having a handle at each end, on which is keyed a pinion that gears into a toothed wheel of comparatively large diameter, which gears into the toothed rack. When it is desired to empty a cesspool, a flexible pipe is carried down into it, and connected at the other end to the tap, which is opened. The handles are turned so as to raise the piston and create a vacuum underneath it, into which the matters will run. When the cylinder is full the tap is shut, the tube disconnected, and the cylinder removed to where it is to be discharged of its contents.

Claims.—1. The general arrangements and combinations of parts, as described in

the specification and represented in the drawings which accompany it, for flushing sewers, drains, and gulleys.

2. The mode of making joints and connecting metal pipes, so as to render them partly flexible; also the method of connecting pipes [rigid].

3. The mode and apparatus for emptying cesspools.

JOHN GLASGOW, Manchester, engineer. *For certain improvements in machinery or apparatus for shearing, shaping, punching, and compressing metals.* Patent dated January 12, 1850.

The apparatus which forms the subject of this patent is intended to manufacture spikes, bolts, or rivets, &c., and consists of a horizontal steam cylinder which contains a piston, the rod of which carries at the outer end a stamping die. Underneath the cylinder there is a horizontal shaft, which carries at one end fast and loose pulleys and at the other two cams. The shaft is made to rotate by an endless band from some prime mover. One of the cams works in a slot cut in the lower part of a sliding plate, which carries at top the receiving die, and moves up and down, by the action of the cam, in front of the stamping die, supported in the end of the piston-rod. Behind the sliding plate is supported the cutting plate which is on a level with the receiving die when the latter is at its highest point. The second cam works a horizontal lever connected by a vertical rod to a second horizontal lever, or jingle, which is thereby worked to and fro in a tube in the same right line as the one running through the centre of the piston-rod. In front of the sliding plate, but in the same horizontal plane as the cutter, there is a stop. The *modus operandi* is as follows: An iron rod, previously heated, is introduced into the receiving die, when the sliding plate is at its highest point, until its further progress is arrested by the stop, the distance between which and the sliding plate determines the length of the bolt, &c. The descent of the sliding plate, while the cutter remains immoveable, shears off a portion of the rod and brings it opposite the stamping die on the piston rod. The attendant then admits steam behind the piston, which drives the stamping die forward, and compresses the iron between it and the jingle, which bears against the other end of the piece of iron, and prevents it being driven out of the receiving die. The steam is now cut off from behind the piston and admitted in front to draw the die back. The revolution of the second cam acts upon the system of levers, and causes the jingle to advance and thrust the finished bolt out of the receiving die. The sliding plate afterwards ascends, and the operation is repeated. The steam valves may be worked by eccentrics instead of by hand. The patentee, who states that by changing the receiving and stamping dies, this machine may be applied to the punching and otherwise shaping of metals, describes next an apparatus for manufacturing screw nuts, which consists of an oscillating lever worked by a crank on a wheel which is driven from a prime mover. This lever, which is broader at bottom than at top, oscillates upon a pin in the lower part, so that each side of the broad portion alternately rises and falls. To each side there is attached a vertical rod, which carries at bottom, a punch and cutter. Under each set of instruments is an anvil, in which there is a guide-piece grooved horizontally, and having a vertical cut. In front of the guide-piece there is a stop. A square piece of heated iron is introduced into the groove until it abuts against the stop; the cutter and punch then descend, the first against the front of the guide-piece, and the other into the vertical cut—whereby a portion will be sheared off and a hole punched in the part which remains in the guide-piece. The rod is then pushed forward, and the next piece, with the hole in it, sheared off. The distances between the stop and the end of the guide-piece, the latter and the vertical hole, are regulated so that the piece of iron, with the hole in it, may be cut off in the form of a square. This piece of iron is subsequently removed to another machine where it is subjected to the well-known operation for tapping female screws.

Claims.—1. The mode of applying the expansive force of steam, air, or other elastic fluid, to the actuating of tools, machinery, or apparatus for shearing, shaping, punching, and compressing metals by means of a piston-rod and piston moving in a cylinder under the influence of steam air, or other elastic fluid.

2. The general arrangements of machinery or any modifications thereof, so long as the essential characteristics of the invention are retained.

ALFRED COOPER, of Romsey, Hants, grocer. *For improvements in steam and other power engines, and in the application thereof to motive purposes; also in the method of and machinery for arresting or checking the progress of locomotive engines and carriages.*

Claims.—1. A rotary engine; and, 2. A new method of applying motive power to land and marine locomotive engines—of both which we shall give a full description in a future Number.

WILLIAM GEORGE HENRY TAUNTON,

Liverpool, Lancaster, C.E. *For improvements in obtaining and applying motive power, and in a means to ascertain the strength of chains and ships' cables.* Patent dated

The "improvements in obtaining and applying motive power," relate to the construction of ships' windlasses that are worked by rocking levers, and to a mode of working ships' rudders and pumps, and are as follow:—

1. The barrel of the windlass is supported in bearings, and carries at the centre a ratchet wheel, as usual, into which take pauls. The paul post carries at top the cross head or rocking lever, which is connected by two pendent rods to the eyes of two cheeks, which respectively encircle a boss on either side of the ratchet wheel. Each boss carries a toothed wheel, and a second wheel with a serrated or indented circumference. Each of the eyes carries a pinion, which gears into the toothed wheel opposite to it, while between the boss of the pinion and the serrated wheel there is interposed a wedge-shaped piece, which is serrated on a portion of its face opposite the serrated wheel. When one end of the rocking lever is depressed, the cheek on that side slides round, the boss of the eye descends, and the pinion which it carries rotates on its axis while the barrel remains immovable, and the wedge descends by its own weight, or by suitable mechanical arrangements. But when this end of the rocking lever ascends, then the pinion does not rotate, and the wedge is forcibly compressed between its boss and the serrated wheel, whereby the barrel will be caused to make a partial revolution.

2. To increase the speed or power of the windlass, the chains connecting the rocking lever and barrel are to be lengthened or shortened accordingly; for this purpose the chains (which are made fast to the cross head, close together, and fall on either side of it), are each made to pass over a pin. These pins are fixed in any pair of two lines of holes made in the crosshead, which diverge from the points of attachment of the chains.

3. A screw is cut upon the axle of the steering wheel, and takes into a worm wheel, which is keyed on the centre of a horizontal cylinder. Two ropes are wound in different directions on the cylinder, one on each side of the worm wheel, and pass under separate pulleys to the rudder head, where they are made fast. By turning the steering wheel in one or other direction, one of the ropes will be wound on and the other unwound from the cylinder, and, consequently, the helm put up or down.

4. The plungers of two pumps are connected to opposite ends of a rocking lever, which is provided with a pendant tail-piece having a slot cut in it. A slide takes into the slot in the tail piece, and is made fast on the crank of a shaft which carries at one end a toothed wheel gearing into a pinion keyed on an axle that is provided with winch handles at each end. The pumps are worked by turning the winch handles, or by moving the rocking lever up and down. When additional speed is required, the rocking lever and winch handles are worked simultaneously.

The "means to ascertain the strength of chains and ships' cables" consists of two pairs of wheels placed at from 15 to 90 fathoms asunder. Each pair is keyed on a strong axle which is supported in bearings. Between the pairs of wheels there is a wheel having teeth on a portion of its periphery only, which is worked by a rocking lever and other arrangements similar to those described under the first head. This partially-toothed wheel works into a toothed rack which slides underneath, and is made fast by a short rope to an endless chain or rope, or to two ropes or chains, which pass round pulleys keyed on the axles of the wheels. Around each of the wheels there is coiled a rope. The pendant ends of the two ropes at each pair of wheels are attached to a slotted bar, to which any convenient number of weights may be attached. The rocking lever is worked until the toothed wheel has arrived near the end. The chain to be tested is then connected to short chains attached to the axles, and the working continued until the plain portion of the periphery of the wheel comes over the toothed rack, which will then be released, and allow the weights to descend and act upon the pairs of wheels by rapidly uncoiling the ropes wound thereon, which will cause the axles to wind on the chain, which will thereby be tested by being subjected to a sudden jerk or strain. The force of the strain will depend upon the weights applied to the pairs of wheels, and the difference between the diameters of the wheels and the axles. For instance, if the weight hung on each cross bar be equal to one ton, the diameter of the wheel 25 feet, and of the axle 1 foot, then the total amount of force thus suddenly applied will be 50 tons.

No claims are made in this specification.

Specifications Due, but not Enrolled.

HENRY COWING, Stamford-street, Blackfriars, gentleman. *For improvements in obtaining motive power, and in steam and other ploughs; in land carriages, in fire-engines, in raising water for draining and other agricultural purposes, and in apparatus for evaporating saccharine and other liquids.* Patent dated January 17, 1850.

JOSEPH NYE, Mill-pond Wharf, Park-road, Old Kent-road, engineer. *For improvements in hydraulic machinery, parts of which machinery are applicable to steam engines and machinery for driving piles.* Patent dated January 17, 1850.

ROBERT BARBOR, Chatham-place, Lock's Fields, Surrey, metal melter. *For certain improvements in artificial fuel, and in machinery used for manufacturing the same.* Patent dated January 17, 1850.

ANDREW BARCLAY, Kilmarnock, N. B., engineer. *For improvements in smelting of iron and other ores, and in the manufacture or working of iron and other metals, and in certain rotary engines and fans, machinery, or apparatus as connected therewith.* Patent dated January 17, 1850.

WEEKLY LIST OF NEW ENGLISH PATENTS.

James Hill, of Staleybridge, Chester, cotton-spinner, for improvements in or applicable to certain machines for preparing cotton, wool, and other fibrous substances for spinning and doubling. July 15; six months.

Tempest Booth, of Ardwick, Lancaster, gun manufacturer, for certain improvements in the method of and apparatus for obtaining and applying motive power. July 15; six months.

Edward N. Smith, of West Brookfield, Massachusetts, in the United States of North America, for a machine to fold paper. July 17.

Edward John Dent, of the Strand, Middlesex, chronometer-maker, for improvements in compasses for navigation, surveying, and similar purposes. July 17; six months.

William Herbert Gossage, of Stoke Prior, Worcester, chemist, for improvements in obtaining certain metals from some compounds containing such metals, and in obtaining other products by the use of certain compounds containing metals. July 17; six months.

Jean Jules Varillat, of Rouen, France, manufacturing chemist, for improvements in the extraction and preparation of colouring, tanning, and saccharine matters from various vegetable substances, and in the apparatus to be employed therein. July 17; six months.

John Melville, of Upper Harley-street, Middlesex, esquire, for certain improvements in the construction of railways and locomotive engines and carriages. July 17; six months.

Henrietta Brown, of Long-lane, Bermondsey, widow and executrix of the late Samuel Brown, for improvements in the manufacture of metallic casks and vessels. A communication. July 17.

John Silvester, of West Bromwich, Stafford, whitesmith, for improvements in straightening, flattening, setting, and shaping hardened steel. July 17; six months.

Ezekiel Edmonds the younger, of Bradford, Wiltshire, cloth manufacturer, for improvements in the manufacture of certain descriptions of woollen fabrics. July 17; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
July 12	2371	William Garnett	Tarporley, Cheshire	Spring for a saddle.
,,	2372	William Crosskill	Beverley Works, near Hull	Feeding apparatus for thrashing machines.
,,	2373	Deane, Dray, & Deane.	King William-street	Steam boiler.
13	2374	William Raynard Lane	Strand	Economic percolator.
,,	2375	William Thomas Loy	King-street, Westminster	Tudor razor guard.
,,	2376	Richard Robinson	Belfast	High combustion furnace.
15	2377	R. Gray and Sons	Uddingstone, Glasgow	Draw-spring lever.
16	2378	Richard Howson and Henry Howson	Manchester	Differential screwing apparatus for presses.
,,	2379	Thomas Key	Charing-cross	Regimental cased serpentcliede.

CONTENTS OF THIS NUMBER.

Mechanics' Magazine,

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No. 1407.] SATURDAY, JULY 27, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

BERTHON'S PATENT CLINOMETER AND ALTIMETER.

Fig. 1.

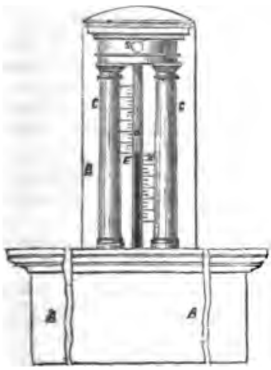


Fig. 2.

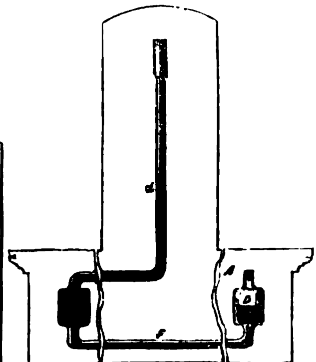


Fig. 3

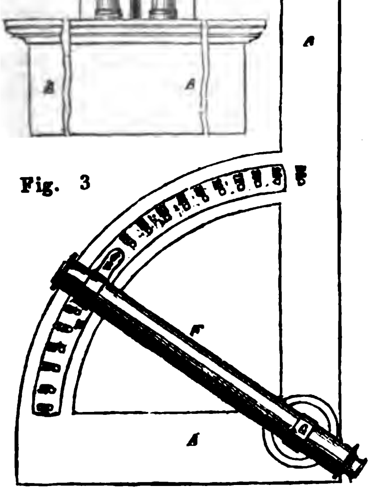


Fig.4.

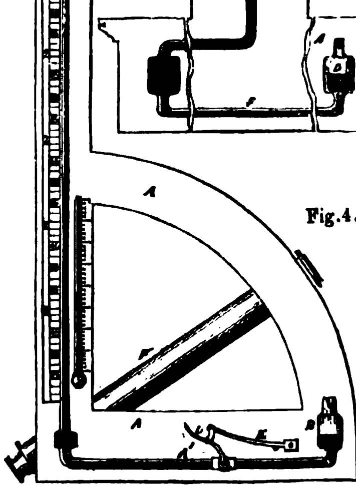
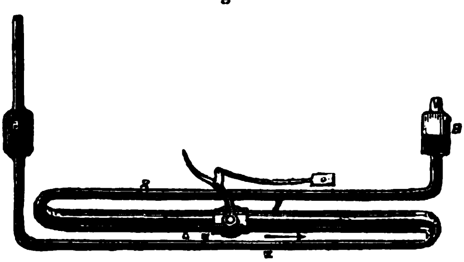


Fig. 5.



BERTHON'S PATENT CLINOMETER AND ALTIMETER.—(SEE ANTE P. 505.)

*The Clinometer.**

All previous mechanical contrivances, including every kind of pendulum used for the purpose of showing the trim of a ship, &c., are so affected by its motion in a sea-way, that no accurate indications can be obtained. And any instrument in which a single fluid is employed, is necessarily so long as to be very inconvenient.

Mr. Berthon's Patent Clinometer combines the advantages of extreme accuracy, even in the worst weather, with the most convenient and compact dimensions, being only from twelve to twenty inches long, besides being very ornamental to the bulkhead of a cabin, &c.

We shall explain the construction of this instrument by referring first to the mercurial or water clinometers previously known. In these, a pipe or glass tube, fixed fore and aft in the ship, is turned up a little at both ends, and the horizontal part being filled with fluid which comes about half-way up each of the vertical portions, a scale is placed against one or both of the vertical tubes, graduated into equal divisions. Then, if it be inclined so that one end is raised above the other, say one inch, the fluid falls half an inch in that tube and rises half an inch in the other, when the two surfaces are again on a level. Thus an elevation or depression of one inch produces only *half* an inch range upon either scale. Therefore, unless the horizontal part be very long, the range is too limited to detect any small change of inclination of the ship's keel.

Now, in the improved clinometer, the range is multiplied by thirteen, which accurately marks the trim of the largest ship to a quarter of an inch.

Fig. 1 is an external elevation of the instrument. A A is a basement of fancy wood, polished, upon which stands the superstructure B B. Between the pilasters C C appears the index tube A, in which a red fluid stands to the mark E K when the ship is on an even keel, but rises or falls according as she is by the head or stern, and the extent is shown in feet and inches upon the scale on either side.

Fig. 2 shows the internal arrangement. D and D′ are two glass bulbs, about an inch in diameter, connected together by the capillary tube E, which varies from ten to eighteen inches in length. D contains mercury only, with the air admitted above. D′ has mercury below, with coloured water superimposed upon it, which rises to the middle of the index tube when the instrument is horizontal.

The sectional area of the index tube is about 1-26th part of that of the bulbs—the mercury thirteen times as heavy as the red water (which contains a little sulphuric acid). S is a screw, which compresses a short piece of vulcanized India-rubber passed over the top of the index tube, and which, when screwed up, prevents the entrance or exit of air, and keeps the fluids steady when the instrument is carried about. Suppose the bulb D to be elevated one inch, then the mercury falls in it a quarter of an inch, and rises the same distance in D′ (flowing along the capillary tube). But in doing so, it displaces upwards the same bulk of water, which raises the column in the index tube 6½ inches, or 13 times as much as when simple tubes with *one* fluid are used.

Again; the capillary tube being fine, allows the mercury to pass but very slowly, so that such a length of time must elapse before any change is apparent, that in a heavy sea the extremes are not shown, but a steady mean is preserved, which corresponds with what would be the exact line of keel in smooth water.

Smaller, and placed athwart ships, it indicates the mean list or inclination. The same instrument, made to act more quickly, is a most convenient and accurate level for all purposes on shore.

The Altimeter.

Two views of this instrument on the opposite sides are given in figs. 3 and 4. A A is a framework of a quadrantal form, on one side of which is a mercurial indicator consisting of two bulbs, B and B′, connected by a horizontal tube and a vertical capilliary tube, which ascends from the bulb B′. At C there is

* Any information concerning the supply of the above instrument can be obtained by reference to the inventor and patentee, Rev. E. L. Berthon, Fareham, Hants.

a steel stop-cock, with a small lever D on the plug, which when pressed by the finger opens it. The spring E closes it again when the finger is raised; F is a telescope which is attached to the other side of the frame A A, and made to turn upon a pivot at G, describing a portion of a circle upon the metal quadrant piece H. This piece has fine holes drilled in it at equal distances along a circular line, of which the centre is the centre of the pivot of the telescope. These holes are placed at a fixed whole number of degrees apart (say five degrees), and are marked accordingly 0, 5, 10, 15, 20, &c. Upon the telescope at R is a fine point L, which stands out laterally from a short spring, and may be placed in any one of the holes of the quadrant. The mode of using the instrument is as follows:

Let the scale of the tube be graduated in degrees, and minutes, and quarters of minutes. Then if the bulbs be about half an inch diameter, the tube A′ one-eighth of an inch diameter and 9 inches long, and the vertical tubes quite capillary, and 16 or 17 inches long, the result will be as follows:—The fluids (mercury and spirit) being about 15:1 in density, an elevation of five degrees will make the spirit rise 15 inches (nearly) very rapidly when the stop-cock is open, and proportionally for smaller elevations.

Now when the point L of the telescope is in the hole O, and the spirit at O, an object seen at the centre of its field of view will be on a level with the eye, and the height of any object above that up to five degrees may be ascertained by the height of the spirit, by simply elevating the whole instrument till it appears in the centre of the field. But if tilted much more, the spirit will come out at the top of the tube; if, then, the object be above five degrees in elevation, und under ten, let the point L of the telescope be inserted in the hole marked 5, and the object observed through it. The spirit will now give the excess above five degrees. If more than ten, and under fifteen, put the point in hole 10, when the spirit will give the excess above ten degrees, and so on.

The instrument, when rested on a steady support on land, may be used without closing the stop-cock: but at sea, the stop-cock is indispensable.

The altitude of the sun, or other heavenly body in respect to which the observation is to be taken, being approximately estimated, the point of the telescope is put into the hole next below the supposed altitude. The instrument is then held in the two hands, with a finger of the right hand placed near the lever of the stop-cock. When the observer has got the object upon the centre of the field, he opens the stop-cock by pressing the lever, and, adapting his motion to that of the ship, he keeps the telescope upon the object for two or three seconds (as in shooting flying), and then suddenly closes the stop-cock by raising his finger. The spirit now remains at the point it reached when the stop-cock was closed, and this, added to the number of degrees marked by the hole in which the point of the telescope is placed, is the altitude of the object observed.

As the insertion of the horizontal column of mercury in the tube connecting the two bulbs (B B′) may possibly interfere with the result, a compensation for this may be effected by making this tube bent, as represented at x, y, z in fig. 5—the portion y being of rather more than twice the sectional area of x and z, and the proper stream through y is regulated by the extent to which the spring stop-cock is opened by a stop q. Thus, suppose the instrument to be suddenly moved horizontally in the direction of the arrow, this would cause the mercury to act by its inertia in the opposite direction, were the communication simple, and not reflex; but the reflex tube y, containing as much mercury as x and z together, counteracts their joint effect by allowing (or rather tending to allow) the same quantity to pass in the other direction, and thus the inertia of the mercury in y will neutralize that of the mercury in x and z.

As temperature, in extreme cases, may affect this instrument, a compensation may be made for this by adapting a sliding scale to the vertical tube, to be set according to the temperature at the time being.

When the altitude of the heavenly body is very great, a small prism or reflector may be placed at the eye-glass of the telescope to throw the image upward, as in the transit instrument.

HINTS TO SHIP-BUILDERS. FROM THE UNPUBLISHED MSS. OF THE LATE BRIG.-GEN. SIR SAMUEL BENTHAM.*

Security against Leakage.—Suppose the deck of a vessel to be at a height little above the water-line, and that this deck, as well as the planking of the side some little way down under water and up to this deck to be made tight against the exit of air from the inside, as of water from the outside, such a vessel would, in most cases, be insubmergible, since the only additional weight tending to sink it would be occasioned by any leakage of water from the bottom which might come into the space previously occupied by air. If the lading were of a kind to occupy much space in proportion to weight—that is, if it were of little specific gravity compared to water—there would remain but little space to receive water of leakage; if the lading consisted of matter of greater specific gravity than water, there must be a great deal of space filled only with air, and so long as that air could not escape, water could not come in to occupy the place of air; it could, indeed, be compressed by water from leakage, and inasmuch as water might thus come in the vessel would sink proportionably, but not enough to occasion the vessel to be entirely submerged.

The water and air-tight deck must be at a height sufficient to enclose air enough to insure against the submersion of the vessel. It is evident that any subdivisions of the hold by transverse or other bulkheads made water-tight throughout, up against the deck, as well as down upon the bottom, and air-tight at the upper part, would afford additional security, as against partial leaks.

With a view to affording this security, all hatchways or other openings through this deck into the hold must be provided with coverings, air-tight as well as water-tight, and they should be very readily applicable.

The space above the water-tight and air-tight deck would in most cases be covered, for the accommodation of the crew; a part of it would, of course, be allotted to the apparatus for navigation: there also would be artillery, or other war-like implements; some of which, should further security require it, might be thrown overboard, as is so often done, and thus add buoyancy to that which the air-tight hold would afford.

Stability or Stiffness.—A great deal of ballast is thought necessary, to give stiffness to vessels of the usual form,—an article expensive in itself, causing delay in taking it in and out, occupying space and capacity which might be better appropriated to provisions or useful lading; ballast, beside, has been one cause of a ship's foundering at sea, as the pigs not being fixed, are liable to be displaced in bad weather.

That stability may be given to a vessel, without being encumbered with ballast, was exemplified in the *Arrow* and the *Dart*; they were both of them worked into Portsmouth Harbour without any ballast, though they had their cables and anchors on deck.

The extension of the breadth upwards, or tumbling out of the hull of the *Arrow* and the *Dart*, was to give stability or stiffness to the vessels, and that in a degree increasing with their inclination—that is the power to counteract further inclination, increasing more and more as the vessel inclined the more. The increase of breadth in these vessels continued upwards to beyond the angle to which a ship is ever liable to heel; ships of the usual form, on the contrary, incline the easier the more they are inclined.

Bitts to go only to the deck beneath, and to be strengthened by a shore instead of a brace. Openings under the gang-boards at the top of the side to serve as chimneys, leading, some from the hold, others from the different decks alternately; these openings to be formed so as to exclude water or dirt.

Fore and aft pieces on the deck entire (as the beams of the upper deck), to form the comings of hatchways; under these, pillars; and between the pillars diagonal braces.

Pillars should be hollow, to serve for ventilation; therefore perhaps rather of iron, and provided with valves and pistons, by which foul air, or, when necessary, water might be extracted. Even the pillars forward and aft at right angles to the rising line should be hollow as well as the perpendicular ones in

* These Notes were made preparatory to a second "Naval Essay" by Sir Samuel, the subject of which was intended to have been the structure of navigable vessels.

midships. These butting against and tied to the beams of the upper deck, and the fin-keelson, would form a trussed beam against racking.

Beams at the first building of a vessel should be coaked to the timbers on each side, to the clamp underneath, and to the water-way above. They should be trussed in midships wherever trusses can possibly be admitted, and tied down to the floor timbers by a series of pillars connected together by straps.

All bulkheads trussed, to prevent racking.

Decks fastened with double-drift taper-headed treenails instead of spikes.

Decks straight athwart ship, as well as fore and aft.

The working of capstans by bars to be discontinued; winches to be used in their stead, so as not to interfere with pillars or trusses.

For strength, the keel and bottom of a vessel should form a *bow*, the deck the *string*. To fasten the string to the ends of the bow, as the middle strakes of the deck are cut by the hatchways, and as the strakes on the sides of the hatchways do not come to the stem and stern, the beams afore and abaft the hatchway should be very broad, so as to form a transverse planking connected to the strakes of the deck by coaks.

In the case of a vessel of great length in proportion to its depth, where the distance between the bottom and the upper deck might not be sufficient to form a tie that could be depended on, for the prevention of hogging, the masts with their stays, instead of being a source of weakness might be made to afford strength in the same manner as a brace affords it to a beam.

It is too frequent in the selection of the timbers that compose the frame of a ship, that scrupulous attention is paid to the choice of trees sufficiently large to admit of forming all the edges of the timber die square, whilst the important circumstance in regard to strength, the direction of the fibres of the wood, is made but a secondary consideration.

Augers, Treenails, &c.—The present augers do not cut the wood clean, but tear and bruise it so as to facilitate the entrance of water. This may be prevented by a side cutter to the borer.

The treenail in use is parallel, and the whole length of it passing through the hole which the head ought to fill up, the hole is gutted, so that the head cannot but be slack enough to admit water. This is prevented, by making the treenails *round*, with a *drift*, and a *taper* head.

There are various pigments or compositions that would resist the moisture of the wood used in shipbuilding, by the application of which substances to the hole or to the treenail its efficiency, as a fastening, would be very much increased; even white lead sufficiently diluted with tar or calareous cements, such as quicklime with oleagenous matter, if applied at the instant previously to driving the treenail, would fix it very firmly against any strain to draw it out.*

Coaks might be of metal as well as wood; for example, short tubes of copper, 4 inches long, 3 inches diameter, and a quarter of an inch only thick; but in most cases wood is on many accounts the preferable material.

Pegs or small treenails for boats might be made with conical heads, like the larger treenails; indeed, heads are still more necessary for pegs than even for large treenails.

Sheathing.—Lackering the interior of copper sheathing has been discontinued without any good ground for the abandonment of this practice, either scientific or economical. It is well known, that by the working of a ship, or in other ways, the seams of sheathing are often opened, and that rents are frequently made in it; a passage is thus made for water between the copper and the ship, and thus the corrosive action of sea-water has place on both sides of the sheathing, although it be only on the interior surface that the decomposition of the metal is advantageous by destroying animal life, and otherwise keeping the surface of the sheathing clean.

Chain-plates.—One of the peculiarities of the *Arrow* and the *Dart* was, that their chain-plates were fixed through the thick strake along the range of the deck of the vessel, instead of being fixed to

* Marine glue is an invention of a subsequent date; but Sir Samuel, in his "Naval Essay," page 134, in speaking of raw hides for the shell of small vessels, he said "especially its impermeability be increased by a coating of caoutchouc," and "this substance might also in large vessels be on many occasions advantageously applied in combination with other substances to the production of the same effect, as in the stoppage of leakage," &c.

channels projecting in the usual mode from the top sides.

By this mode of fixing chain-plates they are attached firmly to the part of the vessel best able to support them; and in consequence of the form of those vessels the shrouds were extended to the same angle as in a vessel of the ordinary construction, notwithstanding the chain-plates did not project beyond the vessel's side.

The advantages of this improvement in point of expense arise from a saving of materials and workmanship for the construction of the ordinary channels; but the disencumbering a ship's side from useless projections is of higher importance—it saves entanglement with similar projections from the sides of other ships, and it enables guns to be worked without impediment from the shrouds; indeed, in some cases, artillery may be placed where there is no channels, in situations where otherwise it could not be admitted of. The chain-plates themselves too, when fixed as in those vessels, are not liable to the usual injury from the rolling motion of the ship or otherwise; so that during the many years the *Arrow* and the *Dart* were in constant active service, not any one of their chain-plates so fixed had ever been broken.

ON THE COMPARATIVE MERITS OF IRON AND WOOD FOR SHIP-BUILDING. BY EDWIN O. TREGELLES, ESQ., C.E.

(Concluded from page 53.)

"The *Royal George*, one of the iron steamers running between Liverpool and Glasgow, a vessel of unusual length in proportion to her beam, when loaded with about 150 tons of dead weight, besides her engines and coals, got on a rock near Greenock, at high water, and was left there during a tide without sustaining any injury; she rested nearly on her centre, and all who saw her were of opinion that no timber vessel could have remained in that position without breaking her back.

"Captain Chaplin, who has had upwards of twenty years' experience in steam navigation, and who was for some time manager of Woodside Ferry, in the course of some remarks on the strength of iron vessels, says, 'I may give you a case in point: the *Cleveland*, built by you, got ashore amongst the rocks on an ebb tide, when she was left high and dry for seven hours, hanging entirely by the heel and forefoot, without sustaining injury either in the hull or engine.'

"2nd. Stowage:

"The shell of a timber-built vessel is so much thicker than that of an iron vessel, that with the same outside dimensions, the latter is frequently 18 inches wider, and 12 inches deeper in the hold, than the former; taking the most favourable part of a vessel, namely, in the centre of the length, in a vessel of 200 tons, the proportion in favour of the iron vessel will be as 5 to 6, but in the ends which are drawn finely off, the disparity is much increased, making the proportion of the whole contents about as 5 to 4; supposing, therefore, that a vessel built of timber could stow 200 tons, she would, if made of iron, have room for 250 tons.

"3rd. Safety:

"In addition, however, to their extraordinary strength, iron vessels afford protection, both to life and property, against the most awful accident that can befall a ship at sea; namely, against fire. I admit that it can signify little to unfortunate passengers of what material the hull of a vessel is made, if her cargo, deck, cabins, and masts are consumed, as no one who might escape the conflagration could then remain in her. But with ordinary precautions, it would be nearly impossible for a fire to take place or to gain head in the hold of an iron ship, provided the hatches were properly secured.

"4th. Speed:

"The material being much lighter to attain the same strength, and occupying less space, the model of the vessel may be made finer, and better adapted for high speed, without a corresponding loss in amount of stowage and carrying qualities; and iron vessels, as they have more buoyancy, are not so liable as timber-built vessels to pitch when in a heavy sea: these assertions are not the result of mere theoretical speculations, but are derived from a long course of observations, guided by the opinions of many practical men who have become converts to the adoption of iron as a preferable material to wood in the construction of vessels.

"5th. Durability:

"It is as yet impossible to assign any period for the duration of iron vessels in salt water, inasmuch as they have not been tried for a sufficient time to enable us to ascertain this point with precision; the want of this proof must, however, be considered favourable from the fact, that were their decay as rapid as that of wooden vessels, such a result would already have become manifest.

"The instance of the *Aaron Manby* will be in the recollection of many: she was

launched in 1822; has been alternately employed in fresh and salt water, and is stated to be in good condition. The *Garryowen* has been about eight years in salt water, and is not yet perceptibly injured by decay. But the iron vessels of the Clyde probably furnish us with more decided proofs than any others of the durability of the material in salt water. It is well known that some of the first built of those vessels were extremely slight, yet it is truly surprising, when the frequent rubbing on the banks to which they are exposed is considered, how little effect time seems to produce upon them; so slight, indeed, is the apparent decay when the vessel is in use, and so much slower is its progress than is exhibited by iron when applied to other purposes in salt water, that many who have observed the fact are led to suppose that some occult or preservative law is in operation, peculiar to iron so employed. A similar effect is said to be observable on the iron rails of a railway; the corrosion of which appears to be much less rapid when they are acted upon by carriages passing along them than when they are lying in detached bars on the road-side.

"We now turn to the consideration of the durability of timber-built ships: and where, I would ask, in the catalogue of objections, real or fancied, to iron ships, is there one to be found equal to that dreadful scourge to wooden vessels, the dry rot? the effects of which are too well understood by shipowners to require any lengthened remarks from me. I should not, however, do justice to my subject did I pass it over in silence. No age has been without its nostrums, its quackeries, and its infallible remedies for the dry rot; and no period has been so productive of them as that in which we live; but, from all I can perceive, this plague is as prevalent as ever. How many stately vessels are mouldering away under this destructive visitation, while their fine and graceful forms conceal the treacherous enemy within!

"6th. Repairs:

"The usual calculation for a timber-built steamer is, that the expense of repairs will in ten or twelve years have equalled the first cost. In a well-built iron steamer, repairs will not, I believe, have become necessary within that period, provided the vessel has not been injured by accidents; and under any circumstances, I feel confident it will be more expensive to keep in repair the copper sheathing alone of a wooden vessel, than to effect the whole repairs in the hull of an iron vessel.

"7th. Cost:

"No one, it may be here remarked, can avoid observing and lamenting the low state in this country of what may be termed mercantile naval architecture, in which men of science meet with little or no encouragement to attempt improvements, and have become weary of a system which for many years has brought them no return. But let us hope for better things in iron ship-building; let us trust that both owners and builders will see that their interest lies, the former in procuring good sound vessels, and the latter in a price that will leave no excuse for imperfect work.

"From a careful consideration of the question of cost, I have arrived at the following conclusions:—

"1st. That a good serviceable iron sailing vessel, not exceeding 300 tons burthen, will be equal in cost to an English-built twelve years' timber ship of the same external dimensions, without including the price of copper sheathing for the latter.

"2nd. That iron vessels of above 300 tons have the advantage of being rather less expensive than wooden vessels.

"3rd. That for every large merchant vessel, iron will be found to be much less expensive than wood.

"4th. That iron sea-going steamers bear also about the same proportion, according to their different sizes.

"5th. That iron vessels for rivers may be built at a light expense, but so built, are unfit for sea-service.

"This estimate is to be considered to apply only generally, as the cost of either wood or iron vessels is ruled by the cost of the materials and the style of finishing.

"8th. Draft of water:

"Iron sailing vessels may be built of any requisite depth and sharpness for holding on in a sea-way, but where a light draft is essential for a peculiar service, it may be attained to a greater extent by the use of that metal than by timber; this advantage, of course, arises from the weight of iron necessary in the construction of a vessel being much less than the weight of wood required for the same purpose."

In the foregoing remarks, by John Grantham, allusion is made to bulk-heads, which are an important provision in case of leakage from striking on rocks or other causes; the bulk-heads are water-tight partitions, going completely across the hold of the ship, dividing it into four, or five, or more, independent parts, so that if a leak occurs in one, the water only rises to a certain level in that division of the vessel without affecting the rest, and a vessel thus arranged may voyage a thousand miles in safety, with a large leak, and without requiring to be pumped.

We must not conceal from ourselves, that a strong prejudice or alarm exists, on account of the aberrations of the compass;

but this difficulty is considered to be completely overcome by proper measures for correcting the errors. We are indebted to Professor Airy for this onward and important step in the march of improvement.

We have quoted largely from the work on iron ship-building, we might give much more with profit, but prefer recommending the work to the perusal of those who are impressed with the importance of the subject as a national question, on which J. Grantham, at p. 68, writes as follows:—

"There could not be a better period than the present, when the foundations of every commercial system seems to be shaken, and men are looking round in dismay at the depression that weighs down every branch of trade, there could not be a better period for considering, with deep attention, a question such as this, and endeavouring to draw from it some assistance towards alleviating the general distress.

"As a national subject, it will be found to possess more claims to attention than are at first apparent."

These observations were written in 1842, and apppear equally applicable in 1849; if this question be rightly considered, and fairly tried, during the ensuing seven years, it will not be needful to write elaborate treatises, to prove that for ship-building "there is nothing like iron!"

The application of iron to form a nest, or series of boats, may be very valuable for passenger ships, six such boats might lie on the deck of a steamer, one under another, occupying only the space of one, by having the thwarts made to unship, and be ready at hand, to be brought into action in a minute during an emergency. Six boats, each weighing about half a ton, would carry 180 to 200 persons, and a system of this kind is exceedingly important for all passenger ships, whether steamers or others.

It cannot be denied that the accident which befell that magnificent ship, the *Great Britain*, in Dundrum Bay, did much to check the progress of this improvement; but whilst it is admitted that this disaster checked the earnestness of our merchants to avail themselves of iron vessels, it may be pointed out as a triumph in the achievements of science. Costly as was that ship in iron, it would have been vastly more so if it had been built of wood; and it is probable that if it had run ashore, as did the iron ship, it would have gone to pieces in less than a week, instead of braving fearful storms for several months; and eventually floated off the beach, yielding to the judicious appliances of the talented engineer who had the charge of her construction. The few cases of failure in iron vessels are widely published, whilst some of the very remarkable instances of escape are scarcely recorded: in addition to the instances already quoted, may be mentioned the accident which befell the *Talbot*, a fine iron steamer that was built by the Neath Abbey Iron Company, to ply between Bristol and Port Talbot; one morning this vessel was leaving Bristol river with a cargo, and being caught aground, was left by the tide, supported by the head and stern, lying completely across the river on her side, and was left so dry as for a boat to float under her: in this position she remained a whole tide until the water rose, when the engines resumed their duties, and conveyed her away uninjured to Port Talbot.

In considering the benefit obtained by using iron in preference to wood, we must not forget that the leakage of an iron vessel is scarcely appreciable, and if leaks occur they are commonly very easily discovered and stopped, so that there is no bilge water; a consideration of great importance in carrying corn and other kinds of food.

It is true that there may exist strong prejudices to be overcome; so there were against steam vessels, as fraught with danger of many kinds; so there were also against the introduction of iron beams instead of wood for steam engines; there are engineers now living who remember this change, and the prejudices; how difficult it would be to avoid the snapping of the beam if the engine struck on the spring beams, how frightful would be the calamity of the cast-iron beam of a pumping engine falling into the engine-house, or of the other end tumbling down the shaft of the mine! Many such prognostications were made, and some realised; but does any engineer and sound mechanic contemplate the idea of reverting to the wooden beam, with its cast-iron caps and wrought-iron straps? An excellent engine-beam of enormous strength might be made of wrought-iron plates, but the attempt would be almost vain to form a framework of wood, however elaborate or well designed, that should be equal to the strength of the cast-iron beams now used for the engines in Cornwall.

If iron were not applicable for engine beams, the engines of Cornwall must of necessity be much smaller in their dimensions and power; the deep mines could not be drained, nor their wealth developed; and so it may be said of iron for the use of vessels;—without it we shall remain stationary, or retrograde, amonst nations in the march of commerce—but if we avail ourselves of the vast advantages placed within our reach, we may again become proverbial for intelligence and prosperity.

Frenchay, near Bristol, 6th of 9 mo. 1849.

PRIZES AWARDED BY THE SOCIETY OF ARTS AT THE ANNUAL DISTRIBUTION OF 1850 IN THE SECTIONS OF TRADE, MANUFACTURES, AND MECHANICS.

From Address by the Council.

The gold medal of the President, for improvements in the machinery or processes employed in the cultivation or preparation of sugar in the British Colonies, has not been awarded; but the new cane press of Mr. Bessemer,—for which that gentleman will receive the Society's large gold medal, though applying only to one part of the process in which a general improvement would appear to be contemplated by His Royal Highness, has the merit of introducing a principle at once new and of great beauty into that process; while, by reducing the weight and cumbrousness of the machinery, much has been done by Mr. Bessemer towards removing the main obstacle for improvement in the working machinery of the colonies of the tropics; viz., difficulty of transport.

The condenser of Mr. Siemens—a gentleman already well known both to the mechanical world and to the members of the Society for several inventions of a very high order—has also the merit of being the development of a new principle, and as such, as well as for the ingenious manner in which that novelty has been carried out in the detail of construction, it has been deemed by the Council worthy of the large gold medal.

As an example of an article of manufacture, in the production of which all attempts had hitherto been unsuccessful, but which has at last been accomplished just when most needed, is to be noticed the full-sized bath, in Stourbridge clay, of Messrs. Rufford and Finch, for which your gold Isis medal has been awarded to these gentlemen. For the production of this article a prize was, at the special suggestion of the President, offered by the Society in the session of 1846-47, with a view to the assistance of the movement for people's baths and wash-houses, then in its infancy.

The goblet which last year the Council announced as being in preparation from the designs of Mr. Maclise, R.A., in accordance with the provisions of the Swiney Bequest, has been perfected, and the cup has been for some time before the Society. The Council feel that they can congratulate the Society on having in this cup obtained a work of art worthy of the fame of Mr. Maclise and of the intentions of the late Dr. Swiney.

[The Address concludes by announcing the following special prize list for 1851:—

The Council offer, in the name of the Society, the large medal and 25*l.* for the best, and the Society's small medal and 10*l.* for the second best treatise on the objects exhibited in the section of Raw Materials and Produce.

A large medal and 25*l.* for the best, and a small medal and 10*l.* for the second best, treatise on the objects exhibited in the section of Machinery.

A large medal and 25*l.* for the best, and a small medal and 10*l.* for the second best, treatise on the objects exhibited in the section of Manufactures.

A large medal and 25*l.* for the best, and a small medal and 10*l.* for the second best, treatise on the objects exhibited in the section of Fine Arts.

Each treatise must occupy, and not exceed, 80 pages of the size of the "Bridgewater Treatises."

The Society will also award its large medal and 25 guineas for the best general treatise upon the Exhibition treated commercially, politically, and statistically; and small medals for the best treatises on any special object or class of objects exhibited.

The treatises for which rewards are given are to be the property of the Society, and if deemed suitable for publication, should the Council see fit, they will cause the same to be printed and published, and will award to the author the nett amount of any profits which may arise from the publication after the payment of the expenses.

The treatise to be delivered at the Society's house, on or before the 30th of June, 1851.

In announcing this list, there is no intention on the part of the Council to confine the rewards of the Society to the subjects named there, though, for the reasons given, they do not anticipate that communications of interest on other subjects will be submitted.]

Subjoined is the list of prizes presented by Lord Colborne, the presentation in each section being preceded by a short explanatory speech:

In the Section of Trade and Manufactures.

To Messrs. Rufford and Finch, for their porcelain bath in one piece, the gold Isis medal.—For design, see *Mech. Mag.*, vol. lii., p. 409.

To Messrs. M'Nair and Co., for their coating for electric telegraph wires, the silver medal.

To Henry Bessemer, for his sugar-cane press, the gold medal.—*Mech. Mag.*, vol. li., p. 381.

To C. W. Siemens, C.E., for his regenerative condenser, the gold medal.—*Mech. Mag.*, vol. li., p. 287.

To George Heaton, for his plan for preventing oscillation in locomotives, the Isis

gold medal.—*Mech. Mag.*, vol. xlviii., p. 477.

To W. H. Henry Smith, C.E., for his flexible breakwater and lighthouses, the Isis gold medal.—*Mech. Mag.*, vol. li., p. 550.

To Antoine F. G. Claudet, for his glass-cutting machines, the silver medal.

To Thomas Syson Cundy, for his pyro-pneumatic stove, the silver medal.

To John Imray, for his investigation of the action of the crank, the silver medal.

To Duncan Mackenzie, for his reader for Jacquard Looms, the silver medal.—*Mech. Mag.*, vol. l., p. 138.

To W. Melvine, for his aphonetic clock, the silver medal.

To W. Pole, for his investigation of the action of the crank, the silver medal.

To Cornelius John Varley, for his improved air-pump, the silver medal.—*Mech. Mag.*, vol. xlv., p. 217, 252.

To Francis E. Colegrave, for his spring saddle girth, the Isis silver medal.

To Goodhue, Clinton, and Co., for their method of constructing metallic attachments to mineral substances, the honorary testimonial.

To J. E. M'Douall, for his vibrating Archimedean drill-stock, the honorary testimonial.

To James Vetch, M.D., R.N., for his medico-chirurgical ambulance, the honorary testimonial.

MACDONALD'S PATENT IMPROVEMENTS IN LUBRICATING MACHINERY, AND IN SPRING CARRIAGES—(SEE ANTE P. 56.)

Specification.

The lubricating of machinery, such as the journals or surfaces of the axles of railway carriages, has hitherto been generally effected by the use of certain compositions in a thick or pasty state, and no method of applying oil or grease in a liquid state to machinery subject to the violent actions and concussions to which the bearing parts of the axles of railway carriages and wagons are subject, has hitherto been adopted. The oil or liquid grease hitherto used has also been applied by manual application, and at intervals, or in a wasteful manner. Now, my invention has for its object the applying oil or liquid grease to the bearing, or rubbing surfaces of the machinery of the axles of railway carriages in a constant and uniform supply, as the same is required, and the saving any surplus oil, so as to prevent all waste. This I effect by the application and adaptation of an air-tight oil box with suitable arrangements for supplying the oil to the axle in the requisite quantities, and excluding the dust from the axle box, as hereinafter described. My invention relates secondly, to a mode of connecting the springs with the axles or axle boxes of railway carriages and wagons. In railway carriages and wagons, as ordinarily constructed, the springs bearing the body of the carriage are connected with the axle boxes, either rigidly or in such manner as to exclude any freedom of motion or play between the spring and the axle box; the consequence of which is a degree of strain or twist upon the carriage spring, axle box, and axle. The second part of my invention is directed to obviating this objection, and consists in adapting a ball or spherical bearing point and surface between the under part of the spring and the upper part of the axle box, in such manner that the spring with the carriage attached, and the axle box with the axle attached thereto, may have a certain amount of free motion, or motion independent of each other, and that thereby the strain to which the parts as ordinarily constructed are subject may be diminished.

The accompanying figures show the improvement above referred to as applied in practice.

Fig. 1 is an end view of the axle box, looking into the box from the end next the wheel, representing also a section of the journal and the brass step.

Fig. 2 is an end view of the axle box from the outside, representing also the axle guard and the spring, and the top of the oil cistern.

Fig. 3 is a sectional engraving, showing the axle box, the oil cistern, the brass steps, and the spring fastenings.

Fig. 4 is a view of the axle box, looking from above it, and showing the position of the oil cistern as applied to the axle box.

In each figure the same parts are indicated by the same letters.

A is the journal of the axle, on which rests the brass step G, and the letters *gg*, represent the brass rim, which rests on the shoulder of the journal at g^1; *aa*, small tubes or nipples for the supply of oil from the air-tight oil box, through the apertures a^1a^1, in the brass step to the journal; B is the nave of the

wheel; CCC, the axle box; *cc*, rims to hold the axle packing; *xx*, axle packing; *e*, e^1, screw for withdrawing the surplus oil; DD, the axle guards; EE, the cross bar, which connects the axle guards under the axle box, and thus fastens the carriage to the axle box; F, the oil cistern; *f*, the air-tight lid; $f^1 f^1$, the holding-down spring; G, the brass step; H, a ball for the spring fastening to work

Fig. 1.

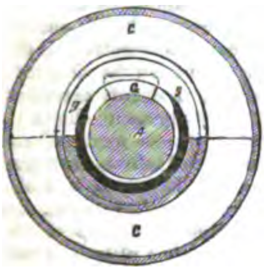


Fig. 4.

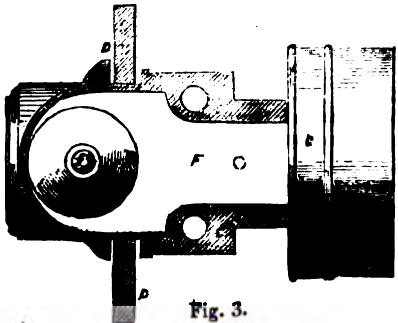


Fig. 2.

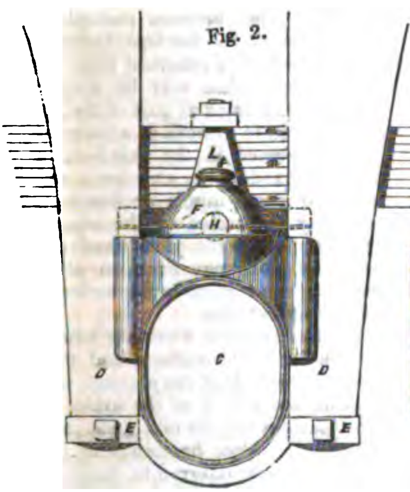
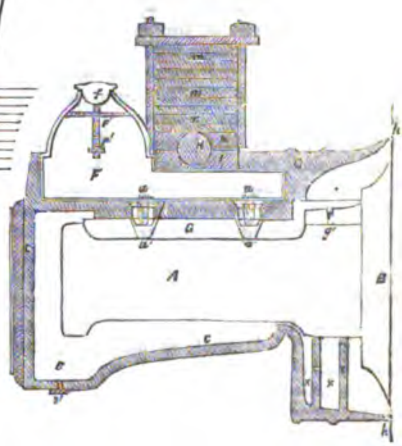


Fig. 3.



on; I, the plate on which the ball H rests; K, the spring fastening which works on the ball H; LL, the cheeks of the spring fastening; *m m m m*, the spring plates.

This air-tight oil or liquid grease vessel may be constructed of sheet iron, or other suitable material, and applied, affixed or attached to the axle box, and connected with the other parts of the machinery in any convenient manner; or in case of carriages not yet constructed, or of carriages being supplied with new axle boxes, it may be cast in the axle box and form a part of the same. In the application of my invention to carriages already made, that is, to the existing carrying stock of railways, the oil vessel may be made of such a form as may suit the description of axle box to which it is to be applied.

The form I have applied to railway passenger-carriages is shown at F, in the accompanying figure. The valve cover, or lid *f*, through which the oil is supplied from time to time, may be retained in its place, and kept air-tight, either by a spring, $f^1 f^1$, a screw, or other means. The spring shown in the figure admits of the air-tight lid being raised for the supply of oil. At the bottom of the cistern are certain openings for feeding the oil or liquid grease to the bearing of the journal, through nipples, or small tubes fastened

to the cistern, as shown at *aa*, with corresponding openings in the brass step to allow the oil or grease to pass to the journal, as at a^1a_1.

In these openings or nipples, or small tubes of the oil cistern, I place a wick of cotton, or other suitable fibrous or porous material, drawn or packed so tightly in the nipples as to regulate the supply to a certain limited quantity per hour, according to the circumstances of the case.

The size of the opening in the nipples, when two openings are used, which I generally employ, is $\frac{5}{16}$ths of an inch in diameter, having from 280 to 300 threads of cotton of a common lamp wick inserted in each hole. This I find to answer extremely well for a railway passenger-carriage having a journal of from 6 to 8 inches long, and 3 inches in diameter, and in good order. Should the oil or liquid grease be supplied to the journal in excess of the requisite consumption, the surplus will be preserved and collected at the bottom of the axle box, as at *e*, and may be from time to time withdrawn by unscrewing the tap screw, e^1. For the purpose of excluding the dust from the journal, the brass step may be made to bear, not only on the journal in the usual manner, but to overlap the inside shoulder of the axle and to extend to the nave of the wheel, and to bear on the shoulder of the axle by a rim, *g*, leaving a space between such rim and the part of the brass resting on the journal, as shown in the sectional view fig. 3.

The axle box may also be constructed so as to overlap and enclose the inside shoulder of the axle, and to come very close to the face of the nave of the wheel at *h h*. With the same view of excluding as much as possible the dust, the bottom part of the axle box may be formed with one or more rings, *c c*, cast on the inside, so as to form a space for the introduction of a suitable material for packing the spaces *x x*, or one of them; this elastic packing, whether of cotton, hemp, worsted, sponge or other material being extended round the underside of the shoulder of the axle and to meet the rim of the brass step *g*, before described.

The brass step may also be so formed as to overlap the shoulder of the axle, and project into a groove formed in the face of the nave, or the axle box may be formed so as to project into one or more grooves in the nave, by one or more feather-edged rim or rims; or one or more rings of metal may be fastened to the shoulder of the axle, and provided with projecting rims, which may be enclosed in the axle box by corresponding grooves encircling the same, so as thereby to exclude as completely as possible the dust from contaminating the oil or liquid grease supplied from the air-tight vessel to the journal, as already described.

In the arrangement shown in the figures of my new mode of connecting the springs of railway carriages with the axles or axle boxes, a ball H, of steel or other suitable material, fits into a plate I, fixed on the top of the axle box, and also into a plate K, attached to the underside of the spring, which is called the spring fastening, a certain space being left between each plate for the motion of the carriage spring. In lieu of this ball, a spherical point nipple or bearing surface may be employed, and may be formed as part of the spring fastening, so as to work in a corresponding cup formed in the axle box, or in the plate fixed on the axle box; or this spherical point, nipple or bearing surface may be formed on the top of the axle box, or on the plate fixed on the axle box, and may work on a corresponding cup formed in the underside of the spring fastening.

By thus allowing a certain amount of free motion to the springs, and through them to the body of the carriage without twisting the axle box, the strain in the axle bearings may be in a great measure prevented. Also, by means of the arrangement just referred to, facilities are afforded for what is commonly called "the lifting of railway-carriages for the purpose of being examined, cleaned, or repaired." On removing the cross-bar, EE, the carriage, with its spring attached, may be quickly raised and disconnected from the axle box without the delay of disconnecting the rigid spring fastenings in ordinary use.

ELECTRICAL EXPERIMENT.

Sir,—Professor Oersted has shown that an electrical current passing along a conductor will induce magnetism in iron; and Faraday has shown that a magnet will induce a current of electricity in a conductor; but I am not aware that it has been observed

that a current of electricity passing along a conductor will, in proportion to its power, render sensible a portion of the latent electricity contained in any piece of iron placed within its influence. I therefore beg to call the attention of your readers to the result of the following experiment:—

I constructed an electro-magnetic coil with 500 feet of No. 16 covered copper wire, with a cylindrical opening an inch and a half in diameter extending longitudinally through the centre of it. Within this opening was placed a bundle containing 3 lbs. of fine iron wire, which, when a current of electricity was passed through the copper wire, formed a compound induced magnet. The coil, with an electro-magnetic contact-breaker, was then placed in connection with a Daniell's battery, when, on touching the compound magnet with a piece of metal, I perceived a slight spark. I then wrapped the magnet in about twenty folds of dry silk, and on presenting a piece of metal, again obtained a succession of sparks, proving that it was not owing to any electricity communicated from the coil.

I then removed the bundle, and inserted a bar of iron, 18 inches long and 1½ in diameter, from which I obtained sparks, but in a very much slighter degree.

I wish to ask whether this phenomenon has been previously observed by any of your numerous readers and correspondents, as I have not seen it mentioned by any of the numerous writers upon electrical science.

I am, Sir, yours, &c.,
C. S.

Romford, July 19, 1850.

THE CYMAMETER.

Sir,—I fear the registration protection for the manufacture of the cymameter by Mr. Fenn (*Mech. Mag.*, No. 1405), will not hold good. It is now at least ten years since I sent for insertion in your Magazine the description of a similar instrument, save that instead of thin *laths*, mine was composed of pieces of wire of equal length clamped between two plates of brass. My description did not appear in your pages, as you stated in your notice to correspondents at the time, because a similar instrument had some *years previously* been described in the *Mechanics' Magazine* by *another* correspondent. Neither Mr. Fenn nor I, therefore, can claim the invention, though as far as *we knew*, we were the contrivers. I may add that I have found my instruments very useful for taking various contours, &c., and also for roughly ascertaining the curvatures of lenses and specula. If Mr. Fenn will refer to your 5th vol., pages 57 and 94, he will find the description of the original here alluded to.

I am, Sir, yours, &c.,
N. S. HEINEKEN.

Sidmouth, July 17, 1850.

BOILER EXPLOSION AT NORTHAMPTON.

Sir,—I have the painful intelligence to communicate, of another steam-boiler explosion, which was accompanied with the loss of life.

The enclosed sketches are those which were hastily made for illustrating the figure of the fracture, before the jury; and in hopes that the publicity of this calamity may in some degree prevent accidents (if indeed this can be strictly termed such) in future, I have the pleasure to forward it for that purpose, and a newspaper containing a report of the inquest.

I am, dear Sir, yours respectfully,
JOS. STENSON.

Inquest.

(From the *Northampton Mercury*.)

On Wednesday, July 17, an inquest was held at the Guildhall, on the body of Henry Chambers, who was killed by the bursting of a boiler at Mr. Adnitt's steam works.

Thomas Worsdall sworn. I live in Court No 3, Wellington-street, and have been employed as stoker at Mr. Adnitt's works. Deceased had the care of both Mr. Adnitt's steam-engines, for seven years to my knowledge. I had left him about three minutes yesterday when the accident happened in the engine-house. The engine was then standing, and had been so for ten minutes or a quarter of an hour. It had been going for about ten minutes that day, but no more. The pump would not work which forces the water into the boiler; in consequence of that he stopped the engine. He had first tried to alter the valve while the engine was going. It was teatime, and I went away to stop another engine. There is no water gauge, but taps. Deceased tried the taps, and so did I, and there seemed to be plenty of water. There are two taps, and water flowed from the top one. We then consider all is right, and that there is plenty of water. As soon as I had stopped the other engine I was going back to the deceased, and had my foot on the threshold when the explosion took place.

By a Juror. The boiler had been out of repair. On Monday she leaked a little, and Mr. West's men had been in it. They caulked the upper part of the tube, and said they thought they had made it secure.

Mr. Joseph Stenson, engineer, sworn. Under the Coroner's order I have examined the boiler. On going into it I found the tube, in which the fire is made, fractured and bent down along its upper surface. It had evidently burst from the pressure of the steam on its external circumference. The water appears to have been too low in the boiler, and the upper part of the tube bore indications of having been overheated. The water must have been low to have admitted of that. The top part of the flue or tube has evidently been bare and red hot. While in a red-hot state the tube would be less able to bear the pressure of steam, and the consequence was a fracture equal to about half the diameter of the tube, the fracture being in a line at right angles to the length of the tube. The point of fracture is at the junction of the third and fourth plates from the front, at that point most subject to

an intense heat, being immediately over the back end of the furnace bars. The fracture is shown in the drawings which I have made for illustration. [The drawings were exhibited to the jury, and explained with great accuracy the nature of the injury. Fig. 1 is a longitudinal section of the boiler; fig. 2 a transverse section of it in the state in which it was before the explosion; and fig. 3, a transverse section after the explosion. F the furnace door, D the dead-plate, the fire-bars from which, as far as *a*, were 5 feet long; H the position of the man hole, and D the front of the safety-valve.] The lead plug was melted. The height of the water level is not what it should be, and the form of the boiler a dangerous one, unless the tube be of greater thickness than it was in this case. I consider the plates too thin for a tube of such large diameter under ordinary circumstances, and extremely dangerous when bare of water. The two gauge cocks are too near together to give a correct indication of the height of water. There should have been three; and I consider a glass water gauge to be indispensable to the safety of steam-boilers, and especially to boilers of this class. The iron in this tube should have been full half an inch thick, instead of five-sixteenths, which it is. The quality of the iron appears to be of fair average. Part of the tube appears to have been red-hot; and as a further proof of its having been overheated, I have some of the hemp and red lead which I found caulked into the joints along the upper portion of the tube. This hemp is burnt and tender, and

Fig. 1.

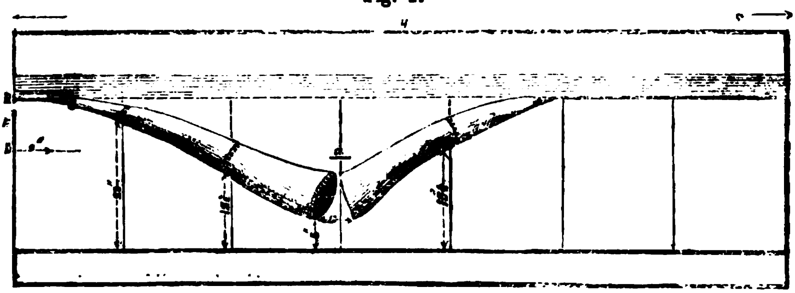


Fig. 2.

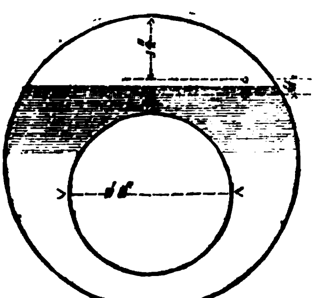
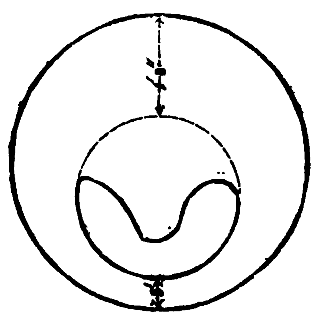


Fig. 3.



some part of it was so burnt I could not carry it away. At all the joints I found hemp and red lead; showing that at some previous time the boiler had been leaky, and repaired in a temporary way. It is the way which would be adopted to repair an injury of this kind; but it shows also that at some previous time the boiler had been heated red-hot. I found the engine had been working at a pressure of 45 lbs. on the square inch. The spindle of the safety valve was not free in its action. This is important, because it would give an undue pressure on the boiler. It was considerably corroded. The force of the steam had blown open and broken the furnace door, and had blown away 18 inches of brickwork at the other end of the tube. The force pump seems to have been in an inefficient state, and was undergoing an examination by the superintendent at the time of the accident. The defective state of the pump would account for the deficiency of water in the boiler. Supposing the boiler to have been filled at eleven, and no water supplied in the interim, the evaporation might account for the explosion at four o'clock, taking into consideration also the short time (ten minutes) during which the engine was at work.

Emanuel West, blacksmith, of Bridge-street, was employed by Mr. Adnitt to repair the boiler on Monday night. It leaked at two or three of the joints, and he caulked it with red lead and hemp.

Mr. Adnitt sworn. Deceased had the management of the engine nine years; ever since it has been up. He had previous experience, and was with Mr. Adkins previously. The boiler was put in when the mill was erected. There has never been any accident with this boiler before. It was quite new when I bought it of Mr. Fairbairn, of Manchester. It was tested up to 150 lbs. on the square inch. Deceased had the superintendence of the mill and the engine. They were under his entire control. When the engine was put up glass tubes were used, but they burst many times and deceased was scalded in consequence, and they were then disused. I cannot account for the statement of Worsdell, that at four o'clock the water flowed from the top tap. I tried it at ten myself, and it then did not move.

Mr. Stenson said when the tube was excessively heated it might force the water out, if the tap were wide open, although the tube itself might be bare. He added, that he considered the force-pump the primary cause of the accident. It was a new one, and of very imperfect workmanship. It would never work till it was greatly altered.

Mr. Gastineau, one of the superintendent engineers of the London and North Western Railway Company, said the glass gauge was much the safest. They had no trouble with them on the railway.

The Coroner having summed up, observing that the incaution of the deceased himself was the probable cause of the accident, a Verdict of Accidental Death, caused by the explosion of the boiler from insufficiency of water, was returned.

MR. BELL'S PATENT BALLOON.

The metropolitan public have been recently favoured with two exhibitions of this balloon—a patent for which was taken out November 23, 1848, and specified in due course (see *Mech. Mag.*, May 26, 1849). According to the newspaper accounts of these exhibitions, they prove that the inventor has the power of guiding his balloon, at will, in any direction he pleases. We must guard our country readers against being deceived by these statements. Mr. Bell can do no such thing.—We were not present at his first ascent, but we witnessed his last; and what we saw was this. We saw the balloon, which is of the shape of an enormous sausage, raised by the gas with which it was charged, to the height of about 1000 feet, and then take a north-westerly course, *which was the direction of the wind at the time;* and which course it kept as long as it remained in sight. Instead, too, of passing endwise through the air—as it was evidently intended to do from the shape given to it—it went *broadside on* with the wind. We saw some flappers at work from the basket—a tail, too, which wagged occasionally—but we did not perceive, and do not believe, that either flappers or tail exerted the slightest influence on the floating mass to which they were attached.

For anything, then, Mr. Bell has done, or, we verily believe, is capable of doing by his apparatus, the art of ærostation is just where it was.

SUPERIOR CEMENT FOR BOTANICAL SPECIMENS.

Sir,—I send you a method which I have adopted of fastening algæ, ferns, and other botanical specimens on paper, and which will, I think, be accepted by many of your scientific readers as much superior to the plans commonly in use. It consists simply in laying the specimen on the paper, and passing a camel-hair pencil, dipped in collodium, across the stem, when a colourless *fixature* is produced; superior to gum in this respect, that it is not affected by moisture, and likewise in its drying almost instantaneously. It will be found that a large quantity of collodium causes the paper to pucker in an unsightly manner; but this, and other minor details respecting the strength of the collodium, &c., a little practice will soon make manifest.

I am, Sir, yours, &c.,

OCTAVIUS CRAWFORD.

Scarbro', June 17, 1850.

AIR-TIGHT BULK-HEADS.

Sir,—In your Magazine of the 6th inst., a claim is set up for General Bentham as having been the first proposer of water-tight bulk-heads in the navy; this is not correct. It had been previously not only proposed to the Admiralty by Capt. Shank, but it had been adopted by the Board; and the *Trial* was built in 1790, as will be seen by reference to "Steel's Elements of Naval Architecture," page 161.

I am, Sir, yours respectfully,

* *

Ipswich, July 15, 1850.

THE ELECTRIC LIGHT.

We are glad to learn, from the Newcastle and Sunderland papers, that the recent exhibitions in the north by Mr. Staite have resulted in the adoption of his light by the Commissioners of the River Wear, as the means of permanently illuminating their South Pier Lighthouse. "All the night exhibitions," say these papers, "having been completely satisfactory, Mr. Staite determined upon giving a mid-day exhibition from the top of the above lighthouse. On Friday, the 7th of June, in the face of the sun-beam, the light burst forth at half-past three o'clock, with a magical and startling effulgence, casting palpable shadows in the face of the very orb of day. The most sceptical must have been satisfied by this severe and unparalleled test; and the impression left on the minds of the spectators was that of astonishment and delight."

H.M.S. "DESPERATE."

The *Desperate* steam-sloop, tried down the river on Thursday last, was built at Pembroke, and fitted with engines, of 400-horse power, by Messrs. Maudslay, Sons, and Field. She made a number of experimental trips between the Nore and Mouse Lights, to ascertain her speed and test her machinery. The result of a series of four runs, at full power, from light-ship to light-ship, gave a mean

speed of 10¾ knots per hour through the water, with 38 revolutions of the engine per minute. One pair of engines was then disconnected, and the trials repeated, giving 8·8 knots, and an engine speed of 38 revolutions as the rate when worked at half power. The trials occupied nearly fourteen consecutive hours, during which the working of the engines was amply tested, and proved highly satisfactory. The boilers were worked at 8 lbs. pressure, and the barometers showed a steady vacuum of 27 inches. The vessel was loaded to a mean draught of 14 feet 2 inches, and at the conclusion of the experiments was left at Sheerness Dockyard to be made ready for sea.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING JULY 24, 1850.

ROBERT BARBER, Chatham-place, Lock's Fields, Surrey, metal-melter. *For certain improvements in artificial fuel, and in machinery used for manufacturing the same.* Patent dated January 17, 1850.

1. Refuse tan bark is proposed to be moistened with water, and then trodden down under the feet of horses until it is reduced to a pulpy state; after which it is to be compressed into the required form, such as bricks, &c., in suitable dies or moulds, and dried. These bricks are to be placed in a basket of open work or wire, and dipped in rosin oil until they are sufficiently saturated, when they are to be left to hang for some time to allow the surplus oil to drain off.

2. The tan, in an unprepared state, is to be put with the requisite quantity of rosin into a copper heated externally until the rosin melts. The rosin and tan are then to be mixed together, and removed to be moulded into shape while in a plastic state.

3. The surfaces of the dies or moulds which come in contact with the mixture are to be enamelled, to prevent its adherence thereto.

Claims.—1. The mode of treating tan and rosin oil for the manufacture of artificial fuel.

2. The employment of tan, in an unprepared state, with rosin, for the production of artificial fuel.

3. The improvement in machinery used in the manufacture of artificial fuel, which consists in enamelling the dies or moulds employed.

[We included this in our last, among specifications "due but not enrolled." Such was the literal fact; the patent being dated the 17th of January, 1850, and the specification due on the 17th of July last, on which day no such specification had been lodged. On the day *after*, however, the patentee did enrol the specification, of which the preceding is an extract; and, in the vain hope of resuscitating the lost patent by a false recital, he states in the preamble that the patent was dated on the 18th, and not on the 17th, its real date. We know not whether the invention is of any value; but if it be, all the world is now free to use it.]

GEORGE SIMPSON, Buchanan-street, Glasgow, civil and mining engineer. *For a certain improvement or improvements in the machinery, apparatus, or means of raising, lowering, supporting, moving, or transporting heavy bodies.* Patent dated January 19, 1850.

Mr. Simpson describes and claims—

1. Various modifications of machinery in which the buoyancy of hollow vessels is applied to the raising, supporting, moving, and transporting of heavy bodies—such as lifting canal boats from a lower to a higher level, instead of by locks. When a heavy body is to be lowered, the buoyancy of the hollow vessel is to be gradually destroyed by admitting water into its interior.

2. The application of compressed air as a support for railway turn-tables, &c.

3. The employment of compressed air vessels to sustain swing or swivel bridges.

4. Raising sunken ships by connecting them to vessels filled with water, and also sunk, into which air is to be forcibly injected, whereby the water will be expelled and the vessels rendered buoyant.

MACGREGOR LAIRD, Birkenhead, gentleman. For improvements in the construction of metallic ships or vessels, *and in materials for coating the bottoms of iron ships or vessels, and in steering ships or vessels.* Patent dated January 19, 1850.

The patentee states, that in consequence of his not having had sufficient time to mature the whole of his invention, he disclaims the latter portion of the title of his patent; namely, that which we have here printed in italics. His improvements in "the construction of metallic ships" are as follows:

1. The "metallic ships" are to be sheathed with corrugated plates, the corrugations of which are parallel, and extend longitudinally from stem to stern. The fore and aft plates have their corrugations of gradually-diminishing size, so that the bows and stern are smooth. The plates are riveted to the frame with the corrugations in the same right line, in order that they may appear to be the continuations one of the other. The vessels are strengthened by having riveted to their inside or outside a number of hollow iron frames bent into the required shape, which at the same time increase their buoyancy.

2. The ships or boats are to be built in sections, provided with flanges, which allows of their being united together by screw bolts and nuts, without the necessity of employing skilled labour for this purpose. The joints are to be rendered water-tight by interposing between the flanges, pieces of vulcanized India-rubber.

3. The decks of iron ships are proposed to be covered with asphalte.

4. In order to enable our iron ships to carry oil, grain, or cargo in bulk, Mr. Laird proposes to construct it with a longitudinal bulkhead, extending from stem to stern, and in the same vertical plane as the keel, and with several cross bulk-heads. The divisions of the vessel are made to communicate with one another, and provided with man-holes.

Claims.—1. Constructing ships or vessels with corrugated metal and hollow iron frames.

2. Constructing metal ships or boats in sections, to facilitate their being easily put together, and to form larger or smaller sizes as required.

3. Covering with asphalte the decks of ships, composed wholly or partly of metal.

4. Constructing metal ships with longitudinal and cross bulk-heads, to enable them to carry oil, grain, or cargo in bulk.

WILLIAM WOOD, Over Darwen, Lancashire, carpet manufacturer. *For improvements in the manufacture of carpets and other fabrics.* Patent dated January 23, 1850.

The improvements which form the subject of this patent relate; firstly, to a mode of projecting wires into the shed, for the purpose of manufacturing piled fabrics; secondly, to a method of manufacturing terry and other piled fabrics, when the pile is produced from the weft.

1. On one side of the loom there is a trough which is partially covered by a flat piece, having one of its edges turned up to form a curved back. A slot is cut in the bottom of the trough at one end, into which a picker takes, which has a smart forward motion given to it at certain intervals, by means of levers acted on by a cam on the main shaft. The rods, which are made with a flat projecting piece at one end, are placed in the trough, and successively thrown into the shed by the picker. The rods are prevented from going too far by the resistance of a buffer of leather, Indian rubber, or other elastic material, placed at the opposite side of the loom, against which they strike, and are prevented from rebounding by being slightly depressed when they leave the trough, through the action of a spring, so that the ends of the rods shall at the rebound come in contact with a similar piece of Indian rubber placed below the opening of the trough. The trough is provided with curved guides, placed at regular distances apart, which serve to conduct the rods into the trough. As the weaving proceeds, the rods are successively drawn out by means of hooks attached to a pitch chain made to rotate from the main shaft. These hooks catch the flat ends of the rods, draw them out, and deposit them on a support, which transfers them to the guides, and thence to the trough. To cut out the rods, they are made with longitudinal grooves, and a cutter is made to travel to and fro in them, whereby the pile will be cut.

2. In weaving fabrics, such as fustians, in which the pile is produced by the weft, the length of the pile is necessarily short and dependent on the distance apart of the warp threads. To remedy this disadvantage, the patentee coils one or more grains helically round the weft, so that when the pile is cut the length will depend upon the number of coils. The fabric is woven in the ordinary manner, with the exception that a soft shoot is thrown in at the back.

Claims.—1. The mode of weaving terry and other like fabrics, also the method of withdrawing and cutting out the rods.

2. The use of helical weft in weaving pile fabrics, in which the pile is made from the weft; also the employment of a soft shoot at the back.

WALTER WESTRUP, Wapping, Middlesex, miller and biscuit-baker. *For improvements in cleaning and grinding corn or grain, and in dressing meal or flour.* Patent dated 24th January, 1850.

The patentee describes and claims,—

1. An apparatus for separating the sound from broken grain, and from extraneous matter, which consists of a revolving cylinder, slightly inclined out of the horizontal plane, which is perforated with lines of oblong and circular holes, sufficiently large to allow the dust, broken grain, &c., to pass through, but not the whole grain. This cylinder is enclosed within an outer casing, and is keyed on a shaft driven from any suitable prime mover. The exterior periphery of the cylinder is provided with longitudinal ribs, having inclined projectors attached to them, which, as the perforated cylinder revolves, sweep the dust, &c., from the inside of the casing into a shoot, whence it escapes into a receptacle provided for it. The grain is in the first instance lifted into the cylinder by the ordinary apparatus employed for such purposes, and issues from the revolving cylinder, after being separated from the defective grains, weeds, and

other extraneous matters on to an endless travelling band that conducts to the smut machine.

2. The smut machine consists of a vertical shaft which revolves within a casing and carries a number of horizontal tables, placed at equal distances apart; and between each two of these tables there are vertical fans. The casing has inside a number of ribs which are just underneath the edges of the tables, one to each, but so as to leave space enough for the passage of the grain between the surfaces. The shaft carries at top a conical table, fluted, serrated, or roughened on its upper surface, on to which the grain is deposited by the endless travelling band. This conical table carries the grain under a set of brushes which partially clean it and sweep it on to the first horizontal table. The horizontal tables, the fans, and ribs, are covered with thin iron plates, and the periphery of the cylinder is perforated like a nutmeg-grater, to produce roughened surfaces. The centrifugal action of the shaft throws the grain against these surfaces, whereby the smut will be partially rubbed off, and will escape through the perforation in the cylinder; after which the grain will fall over the first table and pass between it and the first rib on to the second table, and so on throughout the series. During its passage between the edges of the tables and the ribs, it will be subjected to a smart rubbing. The grain, and such portions of the smut or dust as have not escaped through the perforations, is to be, when it arrives at the last of all, swept into a chamber, wherein it is submitted to the action of a strong current of air, which will have the effect of driving the smut, &c., into the air or a receiver. The cleansed grain is conducted on to an inclined sieve, the meshes whereof are of a size sufficient to allow the smaller ones only to pass through, while the larger ones will slide down into a separate receptacle.

3. The improvements in grinding, consist in employing two pairs of stones, placed one under the other, and mounting the runners, which are the lower ones, on the same hollow vertical shaft. The grinding surfaces of the runners are made conical, like the frustum of a cone, and those of the fixed stones are curved to correspond. The fixed stones are supported in adjustable bearings, to allow of the space between them and the running stones being regulated as required. Between the two pairs of stones there is a vertical wire gauze cylinder, through which the vertical shaft passes. To this portion of the shaft there are attached several sets of brushes which keep in contact with the inside of the wire gauze cylinder, throughout their revolution with the shaft. The grain is supplied to the first or top pair of stones, whereby a portion will be ground, and only partially so; after which it is conducted to the cylinder, through the sides of which the meal will be driven by the action of the brushes. The partially ground grains are conducted to the second pair, where they will be completely pulverized. The object of this arrangement is to prevent the flour which has been ground being subjected to the same process again, and consequently injured. The runners are made with hollows, which communicate with the hollow shaft for the purpose of admitting air between the grinding surfaces. The supply of grain to the stones is regulated by means of a sliding pipe, attached to the shoot, which is moved up and down to increase or diminish the distance between it and a horizontal disc as required. The vertical shaft which carries the runners and the brushes is driven through the intervention of toothed gearing from any prime mover.

4. The flour-dressing apparatus consists of a vertical cylinder with wire gauze or silk, through which passes a vertical revolving shaft that carries a number of horizontal tables and brushes between each two of them. The brushes are kept in contact with the inside of the cylinder, and as the meal is supplied, they drive the flour through the silk or wire sides, while the bran and offal falls from the table until it is wholly separated from the flour—when it is swept into a shoot, whence it passes into a suitable receptacle.

Christopher Nickels, York-road, Lambeth, Surrey, gentleman. *For improvements in the manufacture of woollen and other fabrics.* Patent dated Jan. 23, 1850.

Mr. Nickels describes and claims,—

1. The employment in weaving terry or piled fabrics of a number of hooked rods, in place of the ordinary wires used to form the loops, which are supported in the under part of a bar extending across the work. When the warp is raised, this bar is shogged forwards, so as to retain the warp threads on the hooks while the shed is lowered and the binding weft thrown; after which the bar is shogged backwards to cause the hooks to take out of the loops, and be ready to repeat the operation.

2. Instead of cutting the pile of terry and other like fabrics, it is proposed to obtain the same results by grinding of the top; for this purpose it is subjected to the action of a cylinder having a rough-file surface or coating of emery, glass, or cutting grit, upon its periphery. A rapid rotary motion is communicated to the cylinder.

3. Mr. Nickels gives an undulating appearance, resembling that of Brussels carpets, to piled fabrics, by passing to-and-fro upon its surface a number of edges placed at certain distances apart, and parallel to each other.

JOSEPH LONG, JAMES LONG, both of Little Tower-street, London, mathematical instrument-makers, and RICHARD PATTENDEN, Nelson-square, Surrey, engineer. *For an improvement in instruments and machinery for steering ships, which is also applicable to vices and other instruments and machinery for obtaining power.* Patent dated January 24, 1850.

[We shall give a full description of this invention, with engravings, in our next.]

Specifications Due, but not Enrolled.

WILLIAM BEADON, jun., Taunton, Somerset, gentleman. *For improvements in conveying away or decomposing smoke, and products of combustion from stoves or grates, and in ventilating rooms and residences.* Patent dated January 19, 1850.

AUGUSTE REINHARD, Leicester-street, Leicester-square, Middlesex, chemist. *For an improvement in preparing oils for lubricating purposes, and in apparatus for filtering oils and other liquids.* Patent dated January 24, 1850.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
July 17	2380	Arthur Samuel Hobson	Kew	Contracting and elongating parasol.
19	2381	Charles Ledger	Sheffield	Table cutlery.
,,	2382	James Dannat	Bishop Wearmouth	Domestic mangle.
,,	2383	Isaac and Campbell	St. James's-street, Pall Mall, and 71, High-street, Chatham	Barrack, college, and cabin portable furniture.
22	2384	John Schofield, of the firm of Joshua and Christopher Schofield, and William Barker, millwright, in the employ of the said firm	Cornbrook, Hulme, Manchester	Face plate and cutters for rasping and chipping dye-woods.
,,	2385	William Randel	Birmingham	Hook and eye.
23	2386	Francois Jules Livin Tige	Arthur-street West, London	Bath.
25	2387	Ann Remington	Shaftesbury-crescent, Pimlico	Roasting apparatus.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, Middlesex, civil engineer, for certain improvements in figuring and ornamenting surfaces, and in the blocks, plates, rollers, implements, and machinery employed therein. July 22; six months.

James Bradford, of Torquay, Devonshire, jeweller, for improvements in locks and other fastenings. July 22; six months.

Thomas Wills, of Bow, Middlesex, engineer, for improvements in steam-engines and in pumps. July 22; six months.

Joseph Paxton, of Chatsworth, Derby, gentleman, for certain improvements in roofs. July 22; six months.

Leonard Bower, of Birmingham, Warwick, manufacturer, and Thomas Fortune, of Harborne, Stafford, mechanic, for certain improved machinery for manufacturing screws, bolts, rivets, and nails. July 23; six months.

William Beetson, of Brick-lane, St. Luke's, Middlesex, brass-founder, for improvements in water-closets, pumps, and cocks. July 23; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in obtaining, preparing, and applying zink and other volatile metals, and in the oxides thereof; and in the application of zinc, or ores containing the same, to the preparation or manufacture of certain metals or alloys of metals. July 23; six months. A communication.

George Hazeldine, of Lant-street, Southwark, Surrey, carriage-builder, for improvements in the construction of wagons, carts, and vans. July 23; six months.

Henry Constantine Jennings, of Great Tower-street, London, practical chemist, for improvements in rendering canvas, and other fabrics and leather, water-proof. July 23; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in machinery for cutting files. July 23; six months. A communication.

George Dunbar, Esq., of Paris, for improvements in suspending carriages. July 23; six months.

Langston Scott, of Moorgate-street, London, wine-merchant, for improvements in a mode or modes of preparing certain matters or substances to be used as pigments. July 24; six months.

Charles William Bell, of Manchester, Lancaster, for improvements in apparatus connected with water-closets, drains, and cesspools, and gas and air-traps. July 25; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF JUNE TO 22ND OF JULY, 1850.

William Wood, of Over Darwen, Lancashire, carpet manufacturer, for improvements in the manufacture of carpets and other fabrics. June 24, six months.

Moses Poole, gent., for improvements in machinery for punching metals, and in the construction of springs for carriages and other uses. June 28; six months.

Peter Armand Lecomte de Fontainemoreau, of 4, South-street, Finsbury, Middlesex, for certain improvements in the manufacture of sulphate of soda, muriatic, and nitric acids. (Being a communication.) July 3; six months.

Thomas Dickson Rotch, of Drumlamford-house, Esq., for an improved mode of manufacturing soap. July 3; six months.

William Cormack, 60, King-street, Danston-road, Haggerstone, Middlesex, chemist, for certain improvements in purifying gas, also applicable in obtaining or separating certain products or materials from gas, water, and other similar fluids. July 10; four months.

Robert Andrew Macfie, of Liverpool, Lancaster, sugar-refiner, for improvements in manufacturing, refining, and preparing sugar, also improvements in manufacturing and treating animal charcoal. July 10; six months.

Richard Roberts, of Manchester, Lancaster, engineer, for improvements in the manufacture of certain Textile fabrics, in Machinery for weaving plain, figured, and terry or looped fabrics, and in machinery or apparatus for cutting velvets and other fabrics. July 12; four months.

John Stevenson, of Roan-mills, Dungannon, flax spinner, for certain improvements in machinery for spinning flax and other substances. July 17; six months.

James Thomson, of Glasgow, Lanark, civil engineer, for improvements in hydraulic machinery and in steam engines. July 17; six months.

Tempest Booth, of Ardwick, Lancaster, gum-manufacturer, for certain improvements in the method of, and apparatus for, obtaining and applying motive power. July 19; six months.

Peter William Barlow, of Blackheath, Kent, civil engineer, and William Henry Barlow, of Derby, civil engineer, for improvements in the permanent ways of Railways. July 22; six months.

LIST OF IRISH PATENTS FROM 21ST OF JUNE, TO THE 19TH OF JULY, 1850.

Thomas Dickson Rotch, of Drumlamford-house, Ayr, Esq., for improvements in separating various matters usually found in certain saccharine, saline, and liqueous substances. (Being a communication.) June 24.

James Hard Hoby, of Blackheath, Kent, Esq., for certain improvements of parts of the permanent way of railways, and in shaping iron. July 15.

Francis Tongue Rufford, of Prescott-house, Worcester, fire-brick manufacturer; Isaac Marson, of Gradley, Worcester, Potter; and John Finch, of Pickard-street, City-road, Middlesex, manufacturer, for improvements in the manufacture of baths and wash tubs or wash vessels. July 17.

George Jackson, of Belfast, Ireland, flax spinner, for improvements in hackling machinery. July 17.

Errata in Mr. Burns's Paper on Perspective.—Last col. page 505, line 8, for "error," read "errors;" in page 507, col. 2, line 1, for "be," read "lie." *The figure printed in Prop. 2, belongs to Prop. 3, and that in Prop. 3, to Prop. 2*; in page 508, col. 1, line 2, the word "of" should be inserted after "representations;" the word "and" in line 45, should be omitted: in col. 2, line 17, for "these," read "those," and in line 24, for "indistinctly," read "indistinct."

CONTENTS OF THIS NUMBER.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1408.] SATURDAY, AUGUST 3, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. LONG'S PATENT CURVILINEAL STEERING APPARATUS, VICES, JACKS, ETC.

Fig. 1.

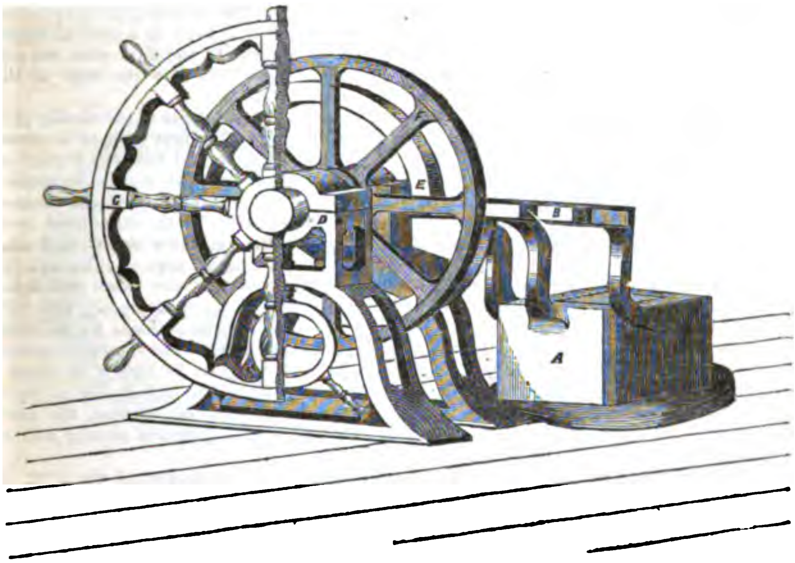


Fig. 12.

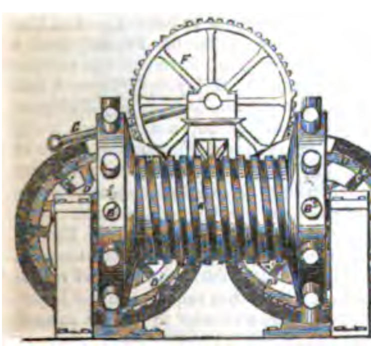
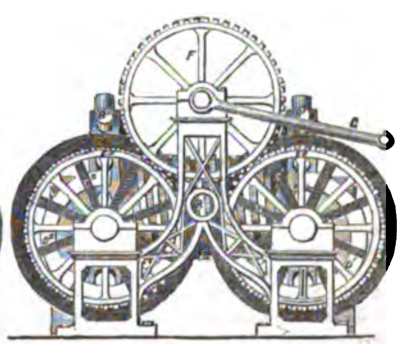


Fig. 13.



MESSRS. LONG'S PATENT CURVILINEAL LEVER STEERING APPARATUS, VICES, JACKS, ETC., (SEE ANTE, P. 79.)

The "Curvilineal Lever," which forms the master feature of all the improved instruments included within the scope of this patent, is a most ingenious though simple application of the spiral to purposes of leverage, and one which offers many obvious advantages. We copy the following explanatory details from the specification of the patentees:—

Curvilineal Lever Steering Apparatus.

Our invention in so far as it regards instruments and machinery for steering ships, consists in the adaptation thereto or embodiment therein of an improved system of leverage, whereby an uniform maximum of useful effect may be obtained from such instruments and machinery with as little drawback from slipping or reaction as may be.

Fig. 1 is a perspective view of a steering apparatus, constructed according to this system. A is the rudder head; B, a horizontal cogged segment attached to A; C is a vertical wheel, such as is in ordinary use, which is mounted in a framework D; and E is what we call a "curvilineal lever," which is attached to the wheel, and works into the cogs of the segment B.

The peculiar sort of curve to be given to this lever, E, and the mode of practically producing it are shown separately in fig. 1*, fig. 2*and fig. 3*. The first thing to be determined is the extreme diameter to be given to the curvilineal lever, and that will depend on the width of the cogs of the segment B*, and of the spaces between them. Supposing the cogs to be 4 inches wide, and the intermediate spaces also 4 inches wide, or the distance from centre to centre to be 8 inches, then the extreme diameter of the curvilineal lever should be twice that, or 16 inches, so that by one entire turn of the wheel, C, and consequently of the lever-plate P (in either direction), the cogged segment, B, will be moved round to the extent of 8 inches, and four revolutions of the wheel will bring the rudder from its centre to an angle of 45°, which is the extent of divergency generally required in steering. (If greater divergency is required this may be obtained by the addition to the segment B of one or more additional cogs at each end). The extreme diameter of the curvilineal lever having been thus obtained, the next thing to be done is to strike a circle of that diameter and divide the circumference of the same into any number of equal parts or segments, as 16, 32, 64, &c. The greater the number of sections, the more minutely exact will be the curve produced; but for all practical purposes sixteen will be found sufficient, as exemplified in fig. 1*.

A space equal to the joint depth of the cogs of the segment B, and of the lever E, which is to work into them, is then to be marked off on the divisional lines, A, B, C, D, &c., and that space is subdivided transversely into as many equal parts (namely, sixteen,) as the circle may have been divided into, as is also exemplified in fig. 1. If then a line be drawn from the point A*, in the circumference of the circle through these divisional lines successively, and inclining continuously towards the centre, in such ratio as to intersect each line at one-sixteenth part nearer to the centre than the intersection immediately preceding, the curve so obtained, will terminate at R, and represent the outer line to be given to the curvilineal lever E. But to find the different centres of the separate portions of the general curve A, R, belonging to each division, the workman must proceed as follows:—Let him draw from the point A a segment through the centre of the circle, fig. 1*, and then a similar segment from the point B; the point where the two segments intersect one another will be the centre from which the portion of the general curve A, R, laying between A and B must be described. And so on throughout the sixteen (or any like number of) divisions, the separate centres from which the successive portions of the curve A, R, are to be described, will be the points of intersection of two segments drawn through the centre of the circle, fig. 1*, from the points BC, CD, DE, &c. It is farther necessary, in order that the bever should have an equal and full bearing throughout on the cogs, with which it interlocks, that it should be bevelled at the sides, and increased in the depth, in a ratio corresponding exactly with that of the interior inclination of the line of curvature. Fig. 2* shows the bevel to be given both in the case of the cogs being taken up on the outside, and of their being taken on the inside of the curvilineal lever. The dark-shaded part represents the bevel required in the former case, and the dotted lines that required in the latter. Fig. 3* is a sectional plan, illustrating the bearings of the cogs and lever in respect to each other.

In all cases the centre of the curvilineal lever should be exactly on a level with the cog-wheel into which it works, when such wheel is placed horizontally; and when the cog-wheel

Fig. 9.

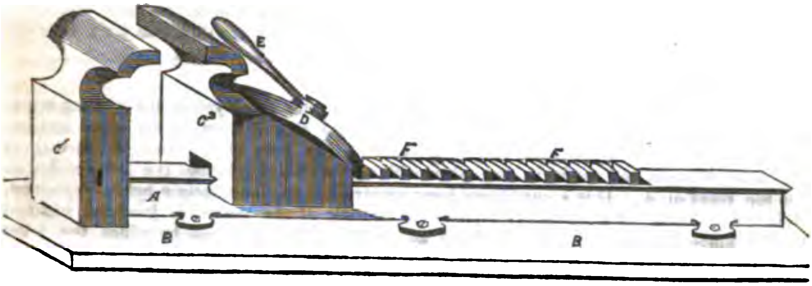


Fig. 1*.

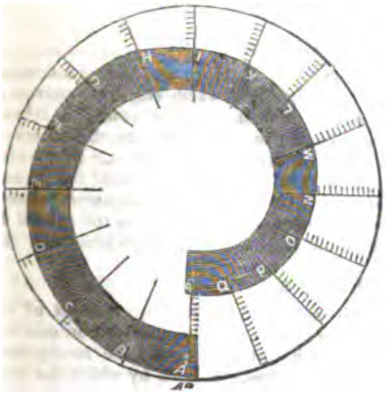


Fig. 2*.

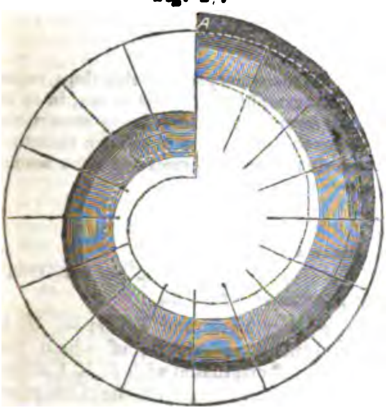


Fig. 3*.

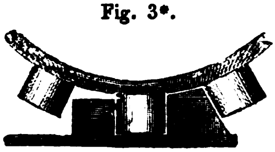
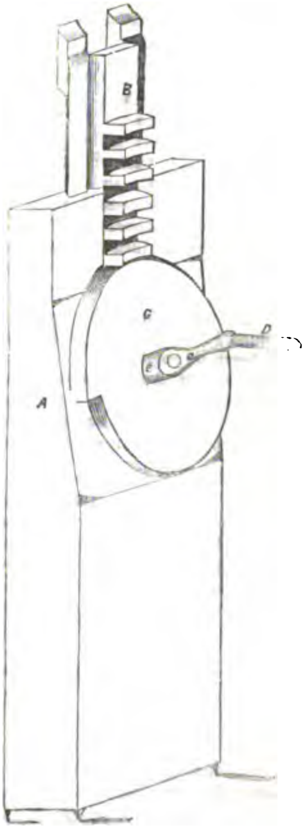


Fig. 15.



is vertical, then the top of the wheel and centre of the lever should coincide. To whatever angle the rudder is brought under these circumstances, by the action of the wheel and lever, it will remain fixed at that angle, and can only be moved in either direction by a renewed application of the hand (or other power employed) to the steering wheel.

Curvilineal Lever Vice.

Fig. 9 exemplifies the application of the curvilineal lever employed in the steering apparatuses, before described, to a vice. A is a slide plate of a T form in its cross section, which is made fast to a basement B. C^1C^2 are the two jaws of the vice, the former of which is a fixture, and made in one piece with the slide-plate A, and the latter slides on the top ridge of A. D is a curvilineal lever constructed on the principle before explained, which is attached to a spindle centred in the back of the moveable jaw and inclined to the slide-plate at an angle of about 20° to 25°. E is a handle by which the lever is turned. F F are a series of cogs affixed to the upper surface of the top ridge of the slide-plate A, and bevelled like those of the cog wheel B, before described. According as the handle E is turned to the right or left, the curvilineal lever takes into or is withdrawn from the spaces between the cogs F F, and the moveable jaw C^2 is made thereby to advance towards or recede from the fixed jaw C^1.

Curvilineal Double-action Crab.

Fig. 12 is a front elevation; fig. 13 a back elevation; and fig. 14 an end view of a double-action crab or purchase constructed on the same principle (but which may be constructed with a single action only). A is a barrel round which the chain works as usual; B^1B^2 two vertical cog wheels which are affixed to the ends of the barrel; D^1D^2 curvilineal levers which work into the cog wheels B^1B^2, and are attached to wheel frames C^1C^2 (for which solid plates may be substituted if preferred.) E^1E^2 are pinions fixed behind the frames C^1C^2, and on the same axes, both of which gear into a toothed wheel F, mounted between the vertical cog wheels B^1B^2. G is a crank handle, which, being applied to the axis of F, actuates the curvilineal levers, and through them the cog wheels B^1B^2, which turn the windlass.

Curvilineal Lifting Jack.

Fig. 15 exemplifies the application of the curvilineal lever to the improvement of the common lifting jack; A is the box; B the slide plate or lift, which is provided on one side with teeth or cogs; and C is the curvilineal lever, which rests in an inclined recess made in the back of the box, and turns on a spindle *e;* D is a crank handle, by which the lever is turned, and caused to act on the cogs of the lift B.

[The specification contains also exemplifications of the application of the curvilineal lever to spanners, ships' windlasses, cranes, &c.]

Claims.

First. We claim the improvement in instruments and machinery for steering ships, represented in fig. 1, and the various modifications thereof exemplified; that is to say, in so far as regards the employment therein of the curvilineal lever E, such lever being constructed according to figs. 1*, 2*, and 3*, and the directions hereinbefore given in relation thereto.

Second. We claim the application of the said curvilineal lever to vices and other machinery for obtaining power, as exemplified.

THE UNITED STATES' MAIL STEAMER "PACIFIC."

New York, May 25th, 1850.

To the Editor of the London Mechanics' Magazine.

Sir,—I have determined to write you an account of the steamer *Pacific*, believing that the same will be acceptable to your numerous readers, coming, as you know, from an unprejudiced source.

The *Pacific* leaves here this day for Liverpool, and is undoubtedly the finest specimen of naval architecture and marine engineering which has ever left these shores; as such I commend her to your notice and kind regards.

The New York and Liverpool U. S. Mail Line of Steamers, of which this forms one,* originated with E. K. Collins, Esq., now the agent of the Company. With Mr. Collins also originated the general outline of the various peculiarities of arrangement, the most obvious of

* The steamers belonging to this line are the *Pacific*, the *Atlantic*, the *Arctic*, the *Baltic*, and the *Adriatic*. They have all been built (by contract) expressly for the American Government service.

which—for it strikes the eye of every beholder—is, *the entire absence of bowsprit and jib-boom.* Her model was designed by Mr. Collins, and is the result of his extensive experience in that line of business, which he has successfully followed for a number of years in this city. She was built under his immediate inspection and directions, by Mr. Jacob Bell, the widely-celebrated ship-builder of New York.

The *Pacific* rates at 3,100 tons, Admiralty measurement. On her spar deck she is 200 feet long; her breadth of beam is 45 feet, and length of hold 32 feet.

Mr. Collins was ably assisted by the scientific skill and persevering energy of one, whose premature death at the early age of thirty-one, has deprived him of the renown so justly his due, and his country of one of the most promising of her engineers—whose modest and unassuming manners could not fail to endear him to all who had the pleasure of his acquaintance, as will, I am sure, be readily acknowledged by those gentlemen whose establishments were visited by Mr. John Farron, when in England and Scotland, previous to entering upon his great undertaking.

The boilers are four in number, each 22 feet long by 13 feet 8 inches wide, and 13 feet 4 inches high; they are divided into four compartments or boxes, whose aggregate width is 10 feet 8 inches. These boxes are filled with tubes placed in a vertical position, with the water inside of them; there are 34 of them in width and 37 in depth—making a total of 1258 tubes in each boiler; the wing boxes contain each 8 tubes in width, 4 feet 6 inches long, and the two middle boxes 9 tubes each in width, 5 feet long; the water spaces between them are 6 inches in the clear, and the outer water legs are 8 inches on the clear; the tube-plates, top and bottom, are half an inch thick; the rest of the boiler is of three-eighth of an inch iron, bolted every 9 inches throughout the water spaces, and stayed throughout in the like substantial manner at top and bottom, both of which are arched.

At the back of the tube-chamber there is a hanging water bridge, and beyond that a damper plate, to contract the draft previous to entering the smoke pipe from one angle of each boiler. There are two furnaces in each tube-chamber (making eight in each boiler), the one placed over the other; the bottom grate is 7 feet and the top one 5 feet long, which gives an aggregate area of 512 feet of grate surface. There are no blowers, as the fuel intended to be consumed is bituminous: the grates have a water bridge at the back, but the top one stops short of the bottom one; thus leaving a large space for up-take and the commingling of the heated air and gases—the general result of all which is a very complete and perfect combustion. This arrangement is due to the late Engineer-in-Chief of the Company (Mr. John Farron), and, although strongly opposed at first, has given the most complete satisfaction. The patented water door of Mr. Isaac Ayres is attached to each of the 32 furnaces of the 4 boilers; and, to complete the description of the boilers and their economic arrangement, I must add the patented blow-off valve of Mr. Charles W. Copeland, the designer of the engines, and one of the firm of the Allaire Company who built them. This blow-off is one of great importance to iron boilers, and consists simply of a check valve, which is opened by the operation of the check valve of the feed-water placed below it, so that every time the feed-water enters, any determined quantity of blow-off escapes, regulated by means of a screw to lengthen or shorten the bottom stem of the blow-off check-valve where it is struck by the top of the feed-water check valve at each ascent.

The engines (two in number) are of the ordinary side-lever kind. The cylinders are 96 inches diameter, with a 9 feet stroke of piston: instead of slide valves for the admission of steam into the cylinders, and providing for its escape into the condenser, there are double beat valves similar to some of those used on the Cornish engines. The largest of the steam ones is 17½ inches, and that of the exhaust 19½ inches diameter. The great advantage of these valves consists in the ease with which they are worked, and consequent little power that is expended in lifting them, as one man at each engine is found sufficient for the largest class. The valves are worked by the patented valves and changing gear of Mr. Robert L. Stevens, which is of a very simple construction, and by means of which the steam can be cut off at any

part of the stroke. The framing of the engines is of wrought iron, except the entablature, which is of cast iron as usual; these parts are well stayed, horizontally, by diagonal stays of wrought iron. The entablature is also stayed to the top and bottom of the cylinder—the former part of which is besides stayed back to the base, which relieves the joint at the bottom of the cylinder and sole-plate from a severe strain, often fatal to American steamers; indeed, the framing generally is novel to them, and in nothing less than omitting both diagonal stays together whenever they intersect; on the contrary, each one is allowed to act freely from end to end, as it should. The framing will appear light to English engineers, as also will the piston-rods and bearings generally, considering ha t her engines are calculated to have steam of 20 lbs. pressure; but American engineers have some peculiar notions in these matters, which at another time I may enter upon and defend. The side beams are of cast iron, and 23 feet 6 inches between the centres. The connecting-rods are 21 feet long from the end centre of the side-lever to the centre of the crank-pin.

The paddle wheels are 35 feet diameter over the floats, and 11 feet 6 inches on the face; there are 28 split paddles to each wheel, 32 inches wide, and the dip is 8 feet 3 inches when her draught of water is 19 feet 7 inches.

The main saloon and ladies' cabin aft, and the dining saloon forward of the engine-room and smoke pipe—but who shall describe them? Cast iron and wood I can get along with, but French Arabesque decoration (with the license of a few human figures), mirrors, Brocatelli marble table slabs, Louis Quatorze furniture, rosewood, satin wood, and other beautiful woods, gilt and brass ornaments, embroidery, chairs, sofas, and carpets, damasks and velvets of the most gorgeous hues, lounges and settees, toilets of marble, panels superbly painted with the arms of every state in Europe, and those of England and America on one side, and America and England on the other (properly quartered, I suppose,) produce the most gorgeous effect, and are perfectly indescribable (at least by me). The ceiling is tinted in calamine, and variously enriched; but few, if any, polychromes are introduced. The lower saloon is lighted through fall lanterns, magnificently ornamented with stained glass, which, reflected in the various mirrors, must be seen to be appreciated. The drapery of the state-rooms I will positively have nothing to do with; it has already crazed half the ladies who have seen it, and cost their husbands I don't know how many thousand dollars. The Company, and Mr. George Platt, the designer of all this mischief, have much to answer for.

The *Pacific*, with her coal on board, drew 18 feet 6 inches of water on a level keel; and so she left on her trial trip on the 20th, and returned on the 21st of this present month of May. She ran up the Bay of New York from Fort Lafayette and Fort Gibson, a distance of seven English miles, in 38½ minutes, or at the rate of eleven miles per hour against a stiff head wind, and a three miles ordinary current, increased by a freshet in the Hudson; by the log she ran over 14 knots with 14 revolutions of her wheels, carrying from 14 to 17 lbs. of steam, cutting off at somewhat less than half stroke, and with the throttle valve but one-fourth to one-third open.

Her speed through still water I calculate at one mile per hour for each revolution of her wheels per minute, as the result of observation of her rate of going, and she was calculated to make 14 revolutions at the commencement and 18 at the end of her passage; and there is every reason to believe that she will accomplish this, as she has thus far at least justified the expectations of her enterprising owners.

The cost of this magnificent steamer is about 115,500*l.* sterling.

Her chief engineer is Mr. James Thompson, who is ably supported by six assistants, and is well worthy of the situation he occupies. Mr. Smith succeeded the late Mr. John Farron as engineer-in-chief to the Company, and is the worthy successor of a worthy man.

Her commander is Ezra Nye, Esq.; of whom nothing more need be said, at least by me, as there are few transatlantic travellers who do not know him as one of the most skilful navigators and gentlemanly men that ever commanded an American packet-ship or steamer—to whom, and his four able officers and his gallant crew, passengers, and ship, I bid God speed, as I must close this long

epistle ere she leaves her pier to breast the Atlantic waves, and do her meed to rub out the lines of demarkation which separate the people of the Old and New Worlds, and carry civilisation with trade and commerce—her handmaids—to every human being on the face of the earth!

T. A. R.

BUOYANT DOCK-GATES.

Injudicious articles in newspapers are often prejudicial to the persons they are intended to serve, of which the praise of the Keyham caisson, in the *Times* of the 4th ult., affords an example *. That article conveys the idea that Mr. Scamp has claimed as his invention the giving buoyancy to a caisson by means of air contained in it; and also the pressing down of the structure by a weight of water received into cisterns having valves in them, and farther, the giving perpendicular sides to the caisson—not any one of which inventions can it be supposed that Mr. Scamp himself would have stated as having originated with him. Mr. S.'s merit is thus likely to be doubted in regard to other particulars which really may have been his own conceptions—and though he has overlooked in the Keyham caisson some collateral advantages obtainable from such a piece of mechanism, neglect of them should rather be ascribed to others than to him, since he ought to have been furnished with the *desiderata* to be provided for facilitating traffic on that important part of the Royal Dockyard, the wharf by the sea-side.

On Mr. Scamp's account it is much to be regretted that the writer of the article in the *Times* above referred to was not better acquainted than he appears to have been with the antecedent caissons, since the caisson at Keyham is on the same principle as that devised by Sir Samuel Bentham, in the year 1798, for closing the entrance to the basin in Portsmouth Dockyard,† and since all the purposes attained by the Keyham caisson are effected in the same manner as in that at Portsmouth.

The caisson at Keyham is described in the *Times* as "a huge hollow iron box of the form of the entrance to the lock, perfectly flat at the sides." "The lower part of this box is formed into an air-chamber." "The capacity of this air-chamber is so adjusted that when the caisson is immersed in water, the confined air exerts a buoyancy a little in excess of the weight of the caisson;" "it

* This we have already pointed out.—see *ante* p. 49.—ED. *Mech. Mag.*

† "*The New Works at Keyham.*—For some time past a very interesting and satisfactory series of experiments at this yard, to test the strength to other capabilities of the large wrought iron caisson which has just been completed by Messrs. William Fairbairn and Sons, of Manchester, for the south entrance to the new basin. As considerable novelty and great ingenuity have been evinced in the design of this caisson, it may interest the scientific public to have a short account of the principle of action, and of the nature of the test to which it has been subjected. It is only right, too, now that the success of the scheme is placed beyond doubt, that due merit should be awarded to its originator, Mr. William Scamp, Assistant Director of Works to the Admiralty, who has realized a very important improvement upon the ordinary form of vessel used for the purpose of closing the entrances to docks and basins.

"The leading dimensions of the monster caisson have already been given in this Journal. It is, in fact, a huge hollow iron box of the form of the entrance to the lock, perfectly flat at the sides, 82 feet 6 inches long at the top, only 13 feet 6 inches wide, and of the enormous depth or height of 42 feet. The lower part of this box is formed into an air-chamber, or what may be termed the lungs of the caisson, by a strong iron deck, which is carried from side to side at a height of about 12 feet from the bottom, and made perfectly air-tight. The capacity of this air-chamber is so adjusted that when the caisson is immersed in water, the confined air exerts a buoyancy a little in excess of the total weight of the caisson; and as, by means of sluice valves, the water is allowed to enter the inside of the caisson, and fill it from the top deck of the air-chamber upwards to the level of the water outside, whatever that may be, it follows that at any point of the tide, and with any depth of water greater than that which would float it, the caisson would swim a few inches clear of the masonry. The total depth of the caisson is about 5 feet greater than the depth of the water at the entrance to the lock at high spring tide, and this space is made available for the means employed for sinking and moving the caisson. A water-tight tank is formed in this part of the caisson, capable of holding 60 to 70 tons of water supplied to it from the water-main of the dockyard; and it depends upon the presence or absence of this quantity of water in the upper tank, whether the caisson remains firmly resting on the masonry, and closing completely the entrance to the lock, or floats a few inches clear of the floor, ready to be hauled by capstans into the recess in the earthwork which has been prepared.

"The ingenious manner in which Mr. Scamp has availed himself of this buoyant principle constitutes the most meritorious feature of his scheme, for the emissions of the small quantities of water in the top tank (which, by means of an ordinary valve placed in its bottom, is accomplished in about two minutes) has enabled him to dispense with the laborious and expensive process of pumping, which has to be resorted to in the case of the ordinary caisson every time a vessel passes to or from the lock. It may be stated, that had the ordinary caisson been adopted at Keyham, the pumping would have required at each removal a force of from thirty to forty men for a space of two hours. In the proportioning of the parts of the caisson, the Admi-

follows that at any point of the tide, and with any depth of water greater than that which would float in it, the caisson would swim a few inches clear of the masonry."

A description of the Portsmouth caisson appeared in No. 1317 of the *Mech. Mag.*, where it is stated to have been "built much in the form of a navigable vessel;" that "at the height of 20 feet the vessel is covered with a deck." Thus buoyancy to a greater amount than necessary was given to the caisson, but by ballast any required degree of immersion was obtained; usually it was kept "at an immersion of somewhat less than 20 feet, whereby as soon as there is 21 feet water at the entrance the dam will have risen one foot, which is sufficient to clear it out of the groove."

Thus it is evident that the way in which buoyancy is given to the Keyham caisson is precisely the same as was first employed half a century ago, and still continues to be employed in the caisson for closing the basin in Portsmouth Dockyard.

For *sinking* the caisson at Keyham, again, the same expedient is resorted to that Sir Samuel devised for sinking the Portsmouth caisson. The *Times* says of that at Keyham, "A water-tight tank is formed in this part of the caisson, capable of holding 60 or 70 tons of water, supplied to it from the mains in the dockyard, and it depends on the presence or absence of this quantity of water in the upper tank whether the caisson remains resting firmly on the masonry, and closing completely the entrance to the lock, or floats a few inches clear of the floor." In the Portsmouth caisson this purpose was effected simply by allowing the tide to flow over the deck at the height above mentioned, but confined to the one side or to the other of the caisson by a longitudinal bulkhead, according as it was required to keep the water in or out of the basin; and as Sir Samuel stated, "what little addition of weight it will require to keep the vessel from rising out of the groove at the time of high water is to be obtained by letting water into one or more of the *cisterns* formed in the vessel immediately under the decks. This water would *of itself run out of the cistern* at the time of low water, even at neap tides, by means of the *penstocks* or *valves*, as shown in the profile." Thus in the Portsmouth caisson provision was made for getting rid of this water by its own gravity through valves from the cisterns, in the same way that it is allowed to escape from the tanks in the caisson at Keyham; how then can it be attributed to Mr. Scamp as a valuable invention of his that he has been enabled "to dispense with the laborious and expensive process of pumping?" It is farther said in the *Times*, that this operation "has to be resorted to in the case of the ordinary caisson every time a vessel passes in or out of the lock. It may be stated that had the ordinary caisson been adopted at Keyham, the pumping would have required at each removal a force of from thirty to forty men for a space of two hours." It is said, indeed, to be true that the old caissons for closing the basin at Sheerness did require from thirty to forty men from one to two hours, and sometimes as many as sixty men; but it was in the avoidance of need for pumping that Sir Samuel's caissons differed most from the caissons, or more appropriately as he denominated them, "Floating Dams," that had theretofore been constructed.

He foresaw, however, that on a certain occasion, though likely to be of very rare occurrence, it might be possible that pumping would have to be resorted to; namely, "if after the water has been let in to fill the cisterns, for the purpose of preventing the dam from floating at *the top of high water*, it should be

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ralty availed themselves of the experience of Mr. Fairbairn, of Manchester; and the result has proved that the caisson embodies within itself an amount of strength adequate to resist without injury the most severe strains. In the course of the experiments the caissons had twice resisted, in the presence of the Captain Superintendent, Lord John Hay, and all the Government Officers and Contractors, the pressure on one side of a depth of water of not less than 36 feet 6 inches. This brought upon the caisson the enormous strain of not less than 1,400 tons; and yet this deflection taken at the middle, and at a point when there were 76 feet 5 inches clear between, the bearing was barely five-eighths of an inch. The ultimate resistance of which the caisson is capable, according to Mr. Fairbairn's calculation, is fully 7,000 tons.

"It has been generally admitted that Mr. Scamp's arrangement of caisson is a very marked improvement, and one which, from its simplicity of action and the quickness with which it can be worked, is likely to be very extensively adopted."

required to open the gate on a *sudden;* the water in *this case* must be *pumped out of the cisterns:* this however would be done in much less time, and with fewer men, than are now necessary to open the basin gates on *every* occasion." No provision seems to have been made in the Keyham caisson for floating it on any such emergency; however, it is not likely often to occur, for Sir Samuel after thirteen years' experience of his caisson—and that during a time of war —was enabled to say, in his official "Statement of Services, 1813," of his floating dams, "this occasional buoyancy is effected without pumping water or unloading ballast."

It is spoken of as a novelty in the Keyham caisson, that "it is perfectly flat at the sides; this, too, is an error—for Mr. Mitchell, the engineer of Sheerness Dockyard, contrived a caisson for use there, the *body* of which had perfectly flat sides. Two caissons were devised by that gentleman, and carried into execution—the one for closing the Graving Dock at Sheerness, the other for closing the Great Basin. Both of these caissons were on the buoyant principle, having air-chambers, as had those of Sir Samuel at Portsmouth, and as has now the Keyham caisson—the difference in all of them (independently of form and materials) being some variation, more or less, in the arrangement of the pipes and valves. Mr. Mitchell's caisson for the Graving Dock was constructed of fir timber, and of a straight form, to suit that material, whereby a very considerable saving of expense was effected. Unfortunately, neither plan nor section of any of Sir Samuel's floating dams can be furnished, though, besides the Great Basin at Portsmouth, he closed the Camber Docks there in the same manner. The originals of his drawings were sent to the Admiralty; his office copies of them were left at the Navy-office when his office was abolished, in 1812; the working drawings, of course, were forwarded to Portsmouth, and some or other of these several plans, elevations, and sections probably still remain in the office.

The provision of a recess for drawing the Keyham caisson into it, appears to be a superfluous work, otherwise than that owing to the form of the caisson it might be liable to topple over in the water of the basin. Sir Samuel's caisson, on the contrary, being much of the form of navigable vessels, was, like them, easily hauled by a guy rope out of the way, either within the basin itself or outside of it in the harbour, if more convenient, and this without the need of "capstans" to haul it into any "recess in earthwork," as is necessary for the caisson at Keyham.

That recess at Keyham can only have been constructed at a considerable expense of money, and by a sacrifice of much convenience in carrying on the general business of the dockyard. The depth of water at Keyham is stated to be, at high spring tides, 37 feet; the caisson is 82 feet long—its depth probably about 40 feet; the recess prepared to receive it must consequently be of that length and depth. Though it is said to be "in the *earthwork,*" yet it must be formed by perpendicular walls of *masonry*, and those walls capable of supporting a pressure equal to the great difference between high and low-water spring tides; instead, therefore, of one and the same double-faced wall serving to sustain that pressure, both as a sea wall and as a basin wall, there must necessarily be a *four*-faced wall, each face of it having equally to resist that great pressure. But, considerable as must be the cost of such a wall, it is of little importance compared to the sacrifice of convenience occasioned by the formation of this recess; it is, in fact, a great gulf cutting off communication along the quay even when the entrance to the basin is closed. Not so at Portsmouth; Sir Samuel's floating dam is itself a bridge, on a level with and close fitting to the piers which at each end of it form parts of the sea wall and quay;—not only a bridge for foot.passengers, but for carts, wagons, and all the heaviest traffic of the yard; and it becomes serviceable immediately on replacement of the dam. Direct passage thus obtained along the sea wall afforded facilities to the business of that important part of the yard theretofore unattainable; and in time of war they were considered as amongst the most important advantages of his caisson. Now indeed, after five-and-thirty years of peace, it is not surprising that a most urgent part of the business of a royal dockyard should be forgotten,—namely,

the expediting of ships while at the wharves or jetties.

The Keyham caisson is doubtless strong enough to support a bridge upon it, and broad enough for general traffic. The abyss made by the recess might be covered over when not in use; and the late progress in engineering skill renders such a covering of easy accomplishment. That progress implies, however, a simplification of the means by which any given effect is obtained; it seems questionable whether simplicity, any more than diminution of expense, has been attained by the Keyham caisson in those particulars where it departs from the examples afforded by the caissons at Portsmouth.

The last observation is not, however, intended as applicable to the material of which the Keyham caisson is formed; iron for such a purpose is now both cheaper and more durable than wood, though the wooden caisson at Portsmouth lasted five-and-forty years, without having received any other than petty repairs, and, probably, at little cost, might have done its duty for some years longer.

It would seem that the iron caisson at Keyham has been made unnecessarily strong; it is capable of bearing a resistance of fully 7,000 tons, but the pressure on one side of it, at a depth of water of 36 feet 6 inches, is stated to have been equal to only 1,400 tons. Supposing, for security sake, that a double degree of strain had been provided for, this would have amounted to 2,800 tons, which, considering that the caisson will never be exposed to the jarrings and vibrations to which a railroad bridge is subjected, might be deemed sufficient; if so, *superfluous* strength has been provided equal to the resistance of a strain of 4,200 tons. There is no other harm in extra strength than the cost which it occasions, and this in dockyard works is little thought of, any more than is ever brought to account the interest which the public have to pay on all capital sunk for works in naval arsenals. M.S.B.

THE TEREDO NAVALIS.

Sir,—In your Magazine of last week I noticed a small paragraph on the prevention of the ravages of the Teredo Navalis by the impregnation of timber with common oil (the experiments were made by desire of Sir Samuel Bentham); closing with the remark, "might it not be worth while repeating Sir Samuel's experiments by impregnating wood with different kinds of low-priced oils?" &c. Perhaps a few remarks concerning this minute, but never-tiring insect, and the means tried, and now in use to preserve the timbers of bridges, piers, and also railway sleepers from its devastating effects may tend to enlighten "M. S. B.," and not prove uninteresting to many readers of your valuable Magazine.

The Teredo has been examined by chemists, and traces of vegetable matter have been found in its intestines. Physiologists have also detected woody fibre by means of the microscope; so there is no doubt that it lives by gnawing and eating the timber; its ravages when it has once entered a pile are exceedingly rapid, and never stop till it has been so bored through, as to be totally useless; this it has accomplished in a few months. It is classed by physiologists at the zero of cold blooded animals; and as the coldest blooded animals are the most tenacious of life, the drug which would be sufficient to kill a human being, or even a frog, would have little or no effect upon it. It therefore seems that the most virulent poison is necessary to affect the sense or cause the death of this little, but formerly mighty obstacle to engineering skill.

Pitch, tar, sulphur, and nearly all chemical matters which are known to be obnoxious to animals, or to destroy life, have been tried; but have all failed. This is to be attributed to one of two reasons—either that the salt-water negatives the poison, or that the poison does not personally affect the worm; besides the sea contains so many different chemical ingredients, according to the rocks, salts and vegetable matters which may exist at any particular spots, so that those chemicals which might possibly answer well at Woolwich or Plymouth, might be entirely nullified at Calcutta or Sydney, and *vice versâ*.

Mechanical means have also been used; copper sheathing was tried, but the teredo entered between the joints, and it would be almost impracticable (even putting the expense aside), to lay the plates so closely as to prevent their entrance; besides, a blow or strain would cause the joints to give at once. Broad-headed nails have also been tried, and

they succeeded; for although they were not driven closely together, the salt-water and iron formed an impenetrable coat of rust to the insect: but this would not do on a large scale, for if the rust were rubbed off from any cause, or one or two nails were not exactly in their places, the pile would be destroyed.

Paine's process consists in soaking the timber first in one solution and then in another; the two solutions having penetrated between the fibres and into the interstices, form a hard and impervious crystallized mass. The total failure of Paine's process, at Fleetwood, is to be attributed to the fact, that the contractor's time having nearly expired, the piles were driven in too soon after saturation; some of them were actually warm; and consequently, before the watery matter had time to evaporate and allow the crystallization to take place, the rush of the tide washed the particles held in solution away.

Creosote or oil of tar has been, and is almost universally, used by engineers and builders for the preservation of the timber piles and supports of bridges and piers, and for railway sleepers. It is obvious that great care must be taken that every crack or crevice in the surface of the wood is thoroughly saturated, and, in order that no part may escape saturation, the following plan is adopted:—One gallon of oil of tar is necessary per cubic foot for bridges and piers; the pressure employed to force it into the pores of the wood is about 150 lbs. to the square inch; each pile is weighed before it goes into the tank, and if when it comes out its weight has not increased 10 lbs. per cubic foot, it is put back into the tank again. The cost of saturation is as near as possible 6d. per cubic foot; the saturation for railway sleepers is a little less—about 8 lbs. of oil of tar, and 5d. the cost per cubic foot. The timber should of course be saturated according to the amount of wear and tear it is likely to suffer—generally from 2 to 3 inches deep is sufficient; as far as the teredo is concerned, they would not attempt to bore if there were only a thin outside coating put on; but the saturation of 2 or 3 inches deep is necessary, in case of any place being rubbed or chipped off.

Several specimens of timber said to have been saturated with creosote, but perforated by the worm, have been brought from different places, but on full inquiries being made, and on examining the piles from which they were cut, it appeared that in one case a piece had been sawn from a pile several inches thick for the purpose of fixing a stay, and of course the heart of the pile being exposed the teredo entered some time after the sample was cut; while in not a few cases the specimens have been cut from guide piles accidentally left, and which of course were never saturated.

The only drawback to using this solution for railway bridges is its highly inflammable nature. The burning of the bridge over the Usk will be fresh in the memory of most of your readers; this was impregnated with oil of tar, and some workmen boring holes with red-hot irons the bridge took fire, and so rapid was its progress, that before any assistance could be obtained, the whole bridge was in flames from one end to the other, and was ultimately burnt down. From the fact that this was a total loss to an insurance-office in London, and also that they have no data or experience in this kind of risk to enable them to fix a per centage, many of the offices refuse to insure railway bridges impregnated with the same stuff as the Usk one, at any price—even should Mr. Phillips live on the spot with the same annihilators as he used at Woolwich. Whether this can be considered of any vital importance or not, engineers are thoroughly aware now, that timber properly impregnated with oil of tar is quite impervious to the borings of the teredo navalis, for in no one instance has it failed, but, on the contrary, when piles impregnated with other solutions have been completely eaten away, the piles impregnated with the oil of tar driven alongside have been examined and found to be as free from the teredo navalis as when first put down.

I am, Sir,
Your most obedient servant,
T. P. J.

City, July 26, 1850.

THE "HYDRO-CARBON," OR RESIN AND WATER GAS.—EXTRAORDINARY EXPOSURE.

[From a Paper by Dr. A. Fyfe, Professor of Chemistry, King's College, Aberdeen, in the *Journal of Gas Lighting*, No. 6, for 10th July.*]

It is well known that when water is passed over iron at a red heat, excluded from air, it is decomposed; oxide of iron is formed, and hydrogen gas is evolved, the purity of which depends on the kind of iron employed. Were the iron clean and pure, then pure hydrogen would be the result; but this very seldom occurs in practice, because, not only does the iron contain foreign ingredients, but it is soiled also by the hands and tools of the workmen in the factory from which it is procured, in the state of filings or turnings. Hence it is that the specific gravity of the gas which it yields is considerably beyond that of pure hydrogen, and the appearance of the flame is different. The light afforded is extremely faint.

When water is passed over carbon, either as coke or charcoal, at a red heat, and excluded from air, decomposition ensues, and a gaseous fluid escapes, with regard to the nature of which different opinions have existed. It was at one time supposed to be, and indeed in works on chemistry it has been described, as a mixture of a variety of gases, the principal of which is light hydro-carbon, better known as *marsh gas*, *coal-mine gas*, and *fire-damp*. More recently-performed experiments, however, have proved that it does not contain hydro-carbon, or at most but a trifling quantity of it. In a paper published by me in the "Edinburgh Philosophical Journal," July, 1837, it is shown that the gas produced by this process is a mixture of hydrogen, carbonic oxide, and carbonic acid, the proportions varying according to the heat and other circumstances. In these trials I found that the carbonic acid was about 18 per cent. After removing it, the remainder was of specific gravity 470, and consisted of a mixture of hydrogen and carbonic oxide, in about equal proportions. By combustion it yielded carbonic acid and water, the light afforded being extremely feeble. As the gas, after the removal of the carbonic acid, was of specific gravity 470, it must have been, before its removal, of specific gravity about 660.

Allowing the correctness of the results now stated, it is evident, that when water is brought into contact with iron and carbon at a red heat, in the same vessel, the gas evolved will be either hydrogen alone, provided the whole of the oxygen unites with the iron; or it will be a mixture of hydrogen, carbonic oxide, and carbonic acid; the proportions varying according to the surface of carbon and iron exposed, and to the facility with which the vapour of the water is brought into contact with the one or the other. Of course the specific gravity will also vary according to circumstances. I have already said that both carbonic oxide and hydrogen burn with a very feeble flame and give very little light. The appearance of the flame of the mixed gases will, of course, vary according to the proportions.

The following experiment was made, with the view of ascertaining the illuminating power of the gas prepared from water by the process recommended by Mr. White, though not exactly with the same arrangement. The retort used was stuffed with charcoal and scrap iron, which were brought to the proper temperature after the door of the retort was secured. Water was then allowed to flow in, the supply being regulated by a stopcock. The gas given off was measured in the usual way. From 7½ lbs. of water 59½ cubic feet of gas were evolved, the specific gravity of which was 574. By lime water the condensation amounted to 16·5 per cent., indicating, therefore, that quantity of carbonic acid; that is, about one-sixth of its volume. Had the specific gravity been taken after abstracting the carbonic acid, it would have been found to be very nearly the same as that formerly mentioned, that is, between 470 and 500. The gas burned with a very feeble bluish flame, yielding carbonic acid and water. With a flame 5 inches long from a jet with an aperture of 1-33rd of an inch, the consumption was 1 foot in 32 min. 30 sec.; that is, 1·84 foot per hour.

The next set of experiments was made on resin, with the view of ascertaining the quantity and quality of the gas which it affords, by decomposition at different degrees of heat. The resin was melted cautiously, and poured into the reservoir connected with the retort, previously brought to the same heat as that requisite for the manufacture of coal gas. By a proper contrivance it was kept warm and sufficiently fluid to enable it to flow easily. 6 lbs. 2 ozs. yielded 61 feet of gas; that is, very nearly 10 feet from the pound. The gas was of specific gravity 640. Lime water indicated 10 per cent. of carbonic acid. With a jet 1-33rd of an inch in diameter, and a 5-inch flame, the durability was 50 min.; that is, 1·2 feet per hour. By the photometer the jet gave the light of 2·2 candles per foot. The Argand with 56 holes, consuming 5 feet per hour, gave the light of 2·45 candles per foot.

* Barlow. 32, Bucklersbury.

This gas, being of specific gravity 640, a cubic foot would weigh 343 grs. The gas, therefore, in all, weighed nearly 3 lbs.; consequently upwards of one-half of the resin employed was wasted by the deposit of carbon in the retort, and by the distillation of volatile oil.

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I come now to consider the quality of the water-resin gas, or, as it is very improperly called, the hydrocarbon gas, and its value for the purposes of illumination. This gas is generated by the decomposition of water and of resin in separate retorts; the former being decomposed by heat, the latter by heat with the aid of carbon and of iron. The gas thus produced is merely a mixture of resin gas—that is of a gas resembling coal gas in its composition—and of hydrogen, with variable proportions of carbonic oxide and carbonic acid, according as the water is decomposed. I regret that I cannot give the results of the manufacture of the gas by the apparatus erected under the superintendence of Mr. White, as I fully expected to have been able to do. In the different attempts which I made to ascertain the quality of the gas manufactured by that apparatus, several circumstances occurred to prevent me from arriving at the truth. In the first trial I found the gas of high illuminating power, *but it was afterwards ascertained that tallow was mixed with the resin*; in what proportion I did not hear. At my next visit the gas was made by using both retorts, employing resin for the one, and water for the other; but it was afterwards discovered *that the water retort was not in action*, consequently the gas collected was entirely that from the decomposed resin, or a mixture of resin and tallow. . . .

I do not, however, consider this of great consequence. I have ascertained the quality of resin gas, of gas from mixture of resin and tallow, and of water gas, *separately*, and as these, by Mr. White's process, are generated in separate retorts, we must consider the gas thrown into the gasometer to be merely a mixture of those mentioned in variable proportions, according to the proportions of the articles employed in their manufacture, and the rapidity with which the one and the other is decomposed. We can thus arrive at the quality of the hydrocarbon gas, as it is called, and its consequent expense for the purposes of illumination, as compared with other sources of light; as, for instance, with coal gas.

As resin is composed of C. 10, H. 7, O. 1, the utmost that it can yield of olifiant is 49; of light hydrocarbon, about 28 from 75 of resin; that is, about 64 per cent. of the former, and about 37 per cent. of the latter. But resin never yields olifiant only; independent of carbonic acid and oxide, the gas is a mixture of olifiant and of light hydrocarbon, with perhaps a slight admixture of uncombined hydrogen. The gas, when it contains about 6 per cent. of carbonic acid, varies in specific gravity from about 570 to 660. I have never found the condensation by chlorine to exceed 8 per cent., thus making the composition to correspond with the specific gravity; for a gas composed of 8 of olifiant and 92 of light hydrocarbon would be of specific gravity a little above 600. I have no doubt that resin gas, when free from carbonic acid, will be found to be of about that specific gravity. I have stated the specific gravity of the water gas, as generated by Mr. White's process, to be about 574. Supposing that it is mixed with an equal volume of resin gas, then the specific gravity ought to be about 580, or somewhere between that and 600; that is, presuming the absence of carbonic acid. Supposing the per centage of carbonic acid to be about 6, then the specific gravity would be about 630.

I must confess that I am at a loss how to reconcile this with the very remarkable statement made by Mr. White, that the gas manufactured from *resin and water* is of specific gravity 924, and contains 12½ per cent. of olifiant. A gas having 12½ per cent. of olifiant, the remainder being water gas or light hydrocarbon, would not exceed 650 in specific gravity. His gas, therefore, must either have contained much more olifiant—indeed, have been composed almost entirely of olifiant—or must have had a very large admixture of carbonic acid or carbonic oxide. Resin gas did not in my trials exhibit beyond 8 per cent. of olifiant. The high specific gravity of his gas must, therefore, have been occasioned by carbonic acid or carbonic oxide, perhaps by both; the latter of which is valuless for the purpose of illumination, and the former detrimental.

With regard to the illuminating power. I have never been able to manufacture gas from *resin alone* with more than 8 per cent. of olifiant. Mr. White states that, by his improved process, he gets the gas from *resin and water* with 12½ per cent. of olifiant. How is it *possible* that, by the addition of resin gas to another gas of lower specific gravity and illuminating power, he gets a gas of higher illuminating power and greater gravity? To me it is a puzzle.

That there is a large admixture of carbonic acid in Mr. White's gas, when he takes the specific gravity, appears certain. He says that now there is but little carbona-

ceous deposit in the retort, owing to the peculiar mode of arrangement and admission of the hydrogen and carbonic oxide. Now, as by the manner of decomposing the water, oxide of iron is formed in the retort, it is evident that the whole of the oygen of the water is not converted to carbonic oxide by its union with carbon; the specific gravity of the gas, therefore, which is evolved from the water ought to be below 522, which is that of a mixture of equal volumes of carbonic oxide and hydrogen; but, suppose that it is not much below that, and that no carbonic acid is present, then to get from resin and water a gas of specific gravity 924, containing olifiant, with the residue composed of equal volumes of hydrogen and carbonic oxide, which it should be were all the oxygen disengaged as carbonic oxide, there ought to be about 87 per cent. of olifiant. Supposing that Mr. White's gas was a mixture of olifiant, carbonic acid, and water gas, which contains equal volumes of carbonic oxide and hydrogen, that the water gas is about 522 specific gravity, and that the olifiant was 12½ per cent., then, to have it of the specific gravity 924, it should be about 12·5 olifiant, 52 water gas, and 35 carbonic acid. Were the carbonic acid removed from this gas the specific gravity would then be a little above 600, most probably the real specific gravity of the *inflammable* gas obtained from resin and water together.

With regard to the illuminating power of the water resin gas, Mr. White has stated that "it is 26·5 per cent. superior to Manchester cannel gas, and 20·5 per cent. to the Salford cannel gas." . . .

By the chlorine test, independent of durability, the illuminating power of Mr. White's gas, containing 12·5 of olifiant, ought to be 64 per cent., instead of 26·5 and 20·5, beyond that of the coal gases he mentions. Of course, if we take durability also into account, the value should be greatly beyond that.

The specific gravity of the Manchester gas at the time I tried it was 451. The durabilities, with the same burner, are as the square roots of the specific gravities. Taking durability into account also, the illuminating power of Mr. White's gas ought to be at least 90 per cent. greater than that of the Manchester gas.

It is evident from this, either that Mr. White's gas must be one *sui generis*, or that there is some strange inaccuracy in the mode of ascertaining the quantity, and of testing its qualities. Can it be that the quantity of gas evolved, say 10,000 feet, of specific gravity 924, from 6 cwt. of resin and 24 gallons of water, and which I have said is a mixture of olifiant, light hydrocarbon, carbonic acid, and carbonic oxide, with perhaps a little hydrogen, was the quantity indicated by the meter, immediately after the gas escaped from the retort, and was then of the specific gravity stated, and that, after it had stood over water in the gasholder for some time, and by which it would lose its carbonic acid, it *then* contained 12·5 of olifiant? If so, the quantity of gas valuable for the purpose of illumination must, by the abstraction of carbonic acid, be far below what Mr. White states. Be that as it may, till Mr. White describes more minutely than he has done, his method for finding the quantity and quality of his gas, I must adhere to the conclusions which the trials I have now recorded warrant; viz., that the quantity and quality of gas, after being properly purified, will be found to be far inferior to what Mr. White has stated; that in all probability the quantity of gas from *resin* will in practice not exceed 8 or 9 feet per pound, that is, about 1,000 feet per cwt.; that the gas after being purified will be of specific gravity not much beyond 600; the condensation by chlorine not beyond 8 or 9 per cent.; a foot of it not giving more than the light of from 2½ to 3 candles. If so, then, when that gas is mixed with about its own volume of water gas, no doubt the quantity will be increased, but to the *serious deterioration of the illuminating power*. That of the water may be said to be *nil*, or a very near approach to it; consequently the reduction in the illuminating power of the other will be just in proportion to the addition; indeed, were it not that the water gas adds to the quantity, and perhaps, from the peculiar mode of generating it, also adds to the specific gravity, of which, as an indication of the value, some have a high opinion, I strongly suspect that Mr. White had better dispense with it altogether, and thus save the trouble and expense of manufacturing, and of storing and transmitting to the public, an article which, for the purpose of illumination, is, as now generated, absolutely useless.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING AUGUST 1, 1850.

THOMAS SCHOFIELD, Cowbrook, Hulme, Manchester, fustian dyer and finisher, and HENRY HORABIN, Royton, Oldham, fustian cutter. *For improvements in machinery for cutting fustians and certain other fabrics to produce a piled surface.* Patent dated January 26, 1850.

Hitherto it has been customary to produce the pile by stretching about two yards

of the length of fustian, &c., in a frame; the workman then introduces the cutter into one of the races, and cuts it up as far as he can reach. He repeats the operation on all the races successively, and then stretches a fresh two yards of the fabric; so that supposing the fustian to be thirty yards long, fifteen distinct operations would require to be repeated. Great loss of time and manual labour thus ensues, as well as an irregularity in the appearance of the fustian at the termination and commencement of each cut. To remedy these disadvantages, the present patentee proposes to pass the fustian over and under two sets of rollers, and over a driving roller. The two ends are united, so as to form a kind of endless band. The rollers are supported in bearings in such manner that the distance between them may be increased or diminished as required, to keep the fustian distended and tight upon the driving roller. As soon as the arrangements are completed—that is to say, the seam of the endless band in front of the workman, and the driving roller out of gear with the shaft—he introduces the cutter into one of the races, and depresses a lever by his foot, which brings the roller and shaft into gear, and consequently causes the endless band of fustian to travel round, whereby the race is cut and the pile formed. When this is completed, the machine is stopped and the cutter introduced into the second race; and so on throughout the series, until the whole is finished. Two or more cutters may be fixed to one handle, and the workman can use one in each hand.

Claim.—The machinery for moving or drawing the fabric towards or against the cutter.

THOMAS BERGER, of Hackney, gentleman. *For improvements in the manufacture of starch.* Patent dated Jan. 26, 1850.

(*Specification*).—"I would at the outset state, that although I shall hereafter describe the use of caustic alkali upon rice, I do not claim the same, inasmuch as Mr. Wickham, of Nottingham, took out a patent for this object in the year 1824. In carrying out my invention, I find it advantageous to steep the rice in the first instance in succession in three or four separate solutions of the caustic alkali (soda preferred) of the following strength; viz., from 190 to 220 grains of pure soda to every gallon of water. I then proceed as follows:—A ton of rice having been thoroughly steeped in three or four separate solutions (of about 300 gallons each) of the caustic alkali, and drawn off, it is now to be ground as fine as possible by means of levigators, with cold water to the consistence of thick cream or paste; to this is to be added one pint of spirit or oil of turpentine, with sufficient cold water to make up the bulk to about 2,000 gallons; the whole is to be well stirred for three hours, after which it is to be passed through a series of coarse flannels, felt or sponge, until all the refuse is deposited upon the flannel or filtering medium; or it may be left quiet for about half an hour, when the starch suspended in the water may be drawn off from the refuse matters.

"These starchy waters are always to be passed through fine lawn sieves, prior to their being allowed to deposit the starch in the settling vessels. The application of water may be repeated, if it is thought desirable, to separate further quantities of starch from the refuse. As soon as the starch is perfectly deposited in the settling vessels it is to be collected, and, if alkaline, neutralized with dilute sulphuric acid, adding eight ounces of sulphate of zinc to every 112 of starch; it is now, after well stirring, to be boxed and finished in the usual way.

"The above is the process I prefer and have found most efficacious, simple, and least expensive, but the metallic salts in general, also sulphate of soda (especially if combined with lime-water), turpentine, alum, and a current of electricity, will severally be found effectual in place of the turpentine and sulphate of zinc. I do not therefore confine myself to the process described, nor to the quantity of either of the agents employed, nor to any particular combination of them.

"When currents of electricity (however produced) are employed, the application should be continued for about two hours on each occasion, and the same is to be passed through fluid starch, as electric currents are commonly passed through fluids; and I stir the fluid starch all the time of applying such currents.

"I use a Smee's battery, of six cells, about 5 inches by 7 inches when acting, to produce 5 cwt. of starch, and I have found it desirable to apply the electricity first to the rice when ground with water, and lastly to the starch previous to its being boxed.

"Another part of my invention consists of the application of a barrel or vessel containing the rice and alkali solution, and caused to revolve by any convenient means at the speed of about one revolution per minute, which I have found to be very efficacious in extracting the gluten out of the rice; the size of the barrel I prefer is 5 feet in diameter, and about 5 feet in length, which will contain a ton of rice; and the 300 gallons of alkali solution I have found, allowing each solution to remain upon the rice three hours while the barrel is at work, to be amply sufficient.

"I do not confine myself to the use of a

barrel, as a vessel of other form will answer the purpose; or, in place of causing the vessel to revolve a stirrer caused to revolve whilst the vessel stands still, will produce a like effect; but I prefer the vessel to revolve.

"What I *claim* is—1. The manufacturing starch from rice by using turpentine and sulphate of zinc as described, and also the straining the starchy waters and boxing the starch in those stages.

"2. The use of metallic salts, also sulphate of soda, turpentine, alum and electricity, whether separately or in combination in the manufacture of starch.

"The use of flannel, felt, and sponge, as a medium for separating the refuse matters from starch.

"4. The application of mechanical stirring, or the rotation of the vessel containing rice when being steeped in a solution of caustic alkali, or other solutions used when making starch from rice."

THOMAS RICHARDSON, Newcastle-upon-Tyne, Chemist. *For improvements in the manufacture of Epsom and other magnesian salts; also alum and sulphate of ammonia.* Patent dated January 26, 1850.

1. Mr. Richardson takes rough Epsom or an impure solution of sulphate of magnesia, and mixes with it a precipitating agent—by preference magnesia. The mixture is well agitated and heated; it is then allowed to stand, in order that the impurities may be precipitated, and decanted off. The pure solution is next evaporated, until it concentrates to from 50° to 60° Twaddle's hydrometer, and is subsequently placed on one side to crystallise. Strontia, baryta, or lime, may be used instead of magnesia as a precipitating agent, but not with the same advantage as it would combine with the ammonia in the solution. When either of the sulphurets, before enumerated, is to be employed as the precipitating agent it must be used in solution. Instead of using the substances (rough Epsom and magnesia) in solutions, they may be ground up together in a moist state, and the Epsom subsequently dissolved out. Carbonate of magnesia is obtained by calcining the magnesia employed in the purifying process. To produce a double salt of magnesia and ammonia, gas water is mixed with a pure or impure solution of sulphate of magnesia, and boiled until rendered neutral. The mixture is allowed to crystallise, and the salt is to be used as a manure. Or sulphate of magnesia, in a damp state, may be subjected to a current of ammoniacal gas, produced by the distillation of gas water, guano, or other ammonia-giving substance. If required, the gas water is to be neutralised by the addition of sulphuric acid.

2. The improvements in the manufacture of alum consist in the employment of (say) eight pits, the first and last of which communicate with one another, and with the intermediate ones, which also communicate with each other by means of a vertical pipe that rises inside one of them, and is fitted with a tap at top, while its lower end is curved, and opens into the lower part of the next pit, and so on throughout the series. Above the mouths of the pits there is a horizontal pipe, communicating with the water reservoir, which is provided with a number of cocks, one for each pit. When the pits are charged with shale, &c., water is admitted into the last, where it remains for some time till the substance is exhausted. Fresh water is admitted, and liquor then flows into the first, where it remains some time to effect a like purpose. Afterwards fresh water is admitted, to cause the liquor to flow into the second pit in the series, and so on until it has reached the required degree of strength: it is then drawn off by a cock at the bottom. When the contents of the pits are exhausted, they are successively replaced by a fresh supply.

3. The patentee proposes to manufacture sulphate of ammonia by employing the double salts produced according to the method described under the first head of the specification, and subliming it in the usual way.

Claims.—1. The employment of magnesia, strontia, baryta or lime, or of the sulphurets of strontium, barium, sodium, magnesium, ammonium or calcium in the manufacture of Epsom or other magnesian salts.

2. The improvements in manufacturing alum.

3. The mode of manufacturing sulphate of ammonia.

WINCESLAS LE BARON DE TRAUX DE WARDEN, of Liege. *For certain improvements in looms for weaving linen and cotton cloths, and in machines for preparing the yarn for such cloths before entering the loom, and in a machine for finishing gray and bleached linen cloths.* Patent dated January 26, 1850.

Baron de Warden specifies and claims—First. An improved construction of loom for weaving linen cloth, the principal novelty in which consists in the employment of two smoothing rollers in the shuttle for equalizing the delivery of the weft and of conical grooved spools.

Second. An improved construction of loom for weaving broad and sail cloth.

Third. An improvement in the construction of warping machines.

Fourth. A machine of a peculiar construction for winding on linen warps.

Fifth. An improved machine for scribbling, cleaning, and dressing cloth.

Sixth. The application of pumice-stone to the dressing of linen.

Seventh. The application of dressed warps to the manufacture of linen and sail cloth.

Eighth. An arrangement of machinery for softening wefts by heat.

Ninth. Nine different improvements in the manufacture of looped fabrics; namely, 1. Heating the yarn before its entering into the needles. 2. The production of patterns by the intervention of the feeders of two different-sized threads. 3. The working of one feeder slacker than the other, and moving the presser-bar in order; to produce a "bouclé" (knotted or buckler-like) fabric. 4. The application of two guides to each feeder, for the purpose of producing a fabric with surfaces of two different materials. 5. The employment of two rows of needles to produce a rib top. 6. The manufacture of imitation Cachmere by dressing the *wrong* instead of the *right* side of knitted cloth. 7. The winding, doubling, and twisting of the yarn in one and the same frame, and during the operation of weaving. 8. The employment of an oscillating detent in combination with a bell-crank lever escapement to stop the working of the loom when the weft breaks. And 9. Making the needle-plate with two or more rows of holes, for the purpose of manufacturing cloth of higher numbers than has been producible by the looms heretofore in use.

EDWIN HEYCOCK, Leeds, York, merchant. *For certain improvements in the finishing and dressing woollen cloths.* Patent dated January 26, 1850.

The object of this invention is to steam-press woollen cloths without stretching the warp threads, or creasing them indelibly from list to list. The patentee employs a frame, which supports a steam plate perforated in the centre only; above this plate is the presser, which is moved up and down in guides by means of toothed gearing. A cloth is laid on the steam plate, and on that the woollen cloth, with the selvages resting on the perforated sides, and turned up: several lengths of cloth are thus disposed of, and the plate then brought down. The steam is turned on, and will penetrate the woollen cloths, but will be prevented from escaping by the edges compressed between the presser and the unperforated portions of the steam plate. When the cloth has been sufficiently steam-pressed, the presser is raised, and the one end is held between a pair of pincher-bars extending the width of the steam plate, and supported in a frame which travels to and fro in toothed racks. By this arrangement the steam-pressed cloths are withdrawn from over the steam plate, and their place supplied by fresh ones, and the operation repeated. Or, the creasing of the cloths may be prevented by folding them to and fro in the steam plate, with the folds projecting beyond the presser, which will, consequently, not be subjected to the action of steam or pressure.

Claim.—Finishing and dressing woollen cloths by steam pressure, without stretching the warp threads or creasing the cloths from list to list.

JOHN DALTON, of Hillingworth, calico-printer. *For certain improvements in and applicable to machinery or apparatus for bleaching, dyeing, printing, and finishing textile and other fabrics, and in the engraving of copper rollers, and other metallic bodies.* Patent dated January 26, 1850.

This invention consists in the manufacture of cylinders or bowls composed of wooden discs and gutta percha, and their employment, instead of those in general use, for the purposes mentioned in the title of the patent, whereby (it is stated) greater strength, resistance, and durability are obtained. Mr. Dalton takes a shaft of the requisite length, and fixes an iron disc at one end. He next takes a number of wooden discs, covered with plastic gutta percha, and places them on the shaft, taking care that the grain shall run in opposite directions. When a sufficient number of discs have been thus fitted to make a cylinder of the desired length, they are firmly pressed together, and an iron disc fitted to the other end of the shaft. The periphery is coated with gutta percha, and when cold is turned true in a lathe. These rollers are to be employed in any of the processes mentioned where the temperature does exceed 100° Fahr.; and also as printing rollers, whereby the use of blankets and lapping will be dispensed with. The iron shafts, to avoid heating, are supported in bearings composed of brass, lined with an alloy consisting of 1 part antimony, 2 parts lead, 7 parts tin, and 10 parts zinc.

The patentee recommends as a lubricator for this purpose a mixture of 2 parts tallow, 1 part black lead, and 1 part sulphur.

Cylinders thus made may be employed in printing both sides of a fabric, and as supports for metal rollers while being engraved, so as to give slightly, and prevent their being indented; also for covering them with varnish, before the engraved parts are subjected to the action of nitric acid. Instead of metal bearings, glass or earthenware may be used.

Claims.—1. The novel combination of materials for, and their application in, the construction of cylinders or bowls with coating of gutta percha.

2. The adaptation and application of these

improved rollers in machinery or apparatus for bleaching, dyeing, printing, and finishing, or for any part of these processes.

3. The construction of apparatus for printing on both sides.

4. The application of the improved rollers in the mode and for the purposes described.

EDWARD RIEPE, Finsbury-square, Middlesex, merchant. *For improvements in the manufacture of steel.* (A communication.) Patent dated January 29, 1850.

1. Mr. Riepe places 280 lbs. of pig iron in a puddling furnace, and heats it till it melts; then throws in from 12 to 16 shovelfuls of cinder slack, and partially closes the damper. When the iron begins to trickle down, 40 lbs. of pig iron are placed on cinder beds near the bridge, and the damper closed. When this last melts and begins to trickle down, it is raked into the melted metal below. The damper is then three parts opened, and the heat continued until it boils, and the well-known blue flames shoot through the cinder slack. The heat is maintained at cherry red, the damper opened, and the mass puddled to and fro under the cinder slack. When the mass begins to granulate and the grains to fuse, the damper is closed and the operation watched; when the boiling ceases, the mass assumes a waxy appearance. The fires are then stirred to keep up the temperature, and a portion taken out in a ball, and tilted or otherwise hammered into shape. In the case of pig iron made from scrapy ore he adds only 20 lbs. of pig iron, instead of 40 lbs., at the latter part of the process; and when using refined Welsh iron, he strews the floor of the furnace with 10 lbs. of best dry granulated clay, and covers the metal with a like quantity of clay.

2. The patentee casts pig iron, or alloys of pig iron and wrought iron, into bars, with notches to facilitate their breaking. They are then covered with clay, and arranged with spaces between. The furnace underneath is lighted, and all the apertures closed except the flue and a small one, which is temporarily closed, but may be opened when required, to allow of a sample being withdrawn to ascertain how the operation proceeds. When the conversion of the iron bars is effected, they are removed, and the clinkers, &c., knocked off.

3. Or the iron may be placed in a fireproof cylinder of stone or eathenware which is heated by a furnace placed underneath, and has its two ends closed with a pipe attached to each. The fire is lighted, and the iron heated to redness. The pipes are then opened, and the air will pass through, and, from the manner in which the bars are arranged, will come into contact with all their sides. When the annealing is completed, the iron is cooled down and removed.

Claims.—1. [As regards the conversion of pig iron into steel.] Regulating the heat in the finishing; the exclusion of atmospheric air from the mass; the use or addition of pig iron at the latter part of the process.

2. Converting pig iron or alloys of pig iron and wrought iron into steel by exposing them to the action of clay at a proper temperature.

3. The peculiar method of annealing bars of pig iron, or alloys of pig iron and wrought iron, by exposing them to atmospheric air when at red heat.

DONALD BEATSON, of Green-street, Stepney, mariner. *For certain improvements in taking, measuring, and computing angles.* Patent dated January, 29, 1850.

Mr. Beatson describes—

1. "An universal altimeter," or instrument for taking altitudes both at sea and on shore. And

2. An instrument for finding on board ship, from the altitude of the sun, the latitude and apparent time.

We shall give in an early Number a full description of both instruments, with engravings.

RICHARD ROBERTS, Manchester, engineer. *For improvements in the manufacture of certain textile fabrics; in machinery for weaving plain, figured, and terry or looped fabrics; and in machinery or apparatus for cutting velvets and other fabrics.* Patent dated January 29, 1850.

The first part of this invention consists in producing a downy appearance in pile-cut fabrics by cutting the loops of unequal lengths, either by using wires of different sizes so that the loops may be of different lengths, or by cutting the loops on alternate sides of the wires, or by weaving the two fabrics face to face, and dividing the fibres alternately nearer to one than to the other. The second part comprehends some twenty-four improvements in looms, the Jacquard included, which would need illustrative drawings to render any description of them intelligible. A third part refers to the apparatus and mechanical arrangements employed in weaving looped fabrics, and to the placing and withdrawing the wires.

JOHN MASON, Rochdale, and MARK SMITH, Heywood, both in Lancashire, machine-makers. *For certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton and other textile materials, and also improvements in the method of preparing yarns or threads, and in the machinery or apparatus employed for such purposes.* Patent dated January 29, 1850.

Among the most noticeable improvements

comprehended in this multifarious specification, are

1. The employment of a spiked roller for beating down the cotton, &c., as it passes to the teaser.

2. Several improved constructions of bobbins and their appendages; also arrangements for driving them.

3. Various modifications in the construction of carding machines.

4. An improved mode of winding on the yarn.

JOEL SPILLER, Battersea, Surrey, engineer. *For improvements in cleaning and grinding wheat.* Patent dated January 29, 1850.

1. In Mr. Spiller's improved wheat-cleaning machine, there is a framework which carries at the upper part five inclined rollers, two of which have wires coiled spirally round them, and are arranged with a plain roller on either side. The whole five are supported in moveable and distinct bearings, which are rounded at top and bottom, but have flat sides, so that when one of them is moved round by means of a handle, the rest will follow the same course, whereby the spaces between the wired rollers and the smooth ones will be increased or diminished accordingly to suit the different sizes of grain. The rollers are made to revolve, and the grain is supplied from a hopper. The straw and small grains fall through the vacant spaces, while the grain is carried by the wired rollers to the discharge end, whence they are conducted to a bruising apparatus, for breaking the mud or earth which may adhere to it. This apparatus consists of a cylinder fluted on its inside periphery, within which turns another cylinder having serrated edges attached to its external periphery. The grain falls from this apparatus into a separator, which consists of two vertical steel plates placed a certain distance apart, and united at the edges by strips of wood. One of the plates is perforated with oblong holes, and the other with circular ones. A reciprocating motion is given to the separator, whereby the grain and dust are driven against either side alternately, which has the effect of causing the grain to pass through the oblong perforations into a receiver, and the dirt, &c., through the circular ones. The finer particles of dust are further separated from the grain by drawing a current of air up the receiver by means of a fan.

2. Mr. Spiller's improvements in grinding wheat consist in forcing air through small vertical holes drilled in the runner between the grinding surfaces, or through boxes sunk in the face of the fixed stone. He proposes also to immerse the lower part of the fixed stone in a stream of running water, for the purpose of absorbing as much of the heat as possible developed by the grinding process.

FRANCIS EDWARD COLE COLEGRAVE, Brighton, gentleman. *For improvements in saddles, parts of which improvements are also applicable to the standing rigging and other furniture of ships or vessels, and to the connecting links and chains of railway carriages, and other purposes where tension combined with a certain degree of elasticity is required.* Patent dated January 29, 1850.

The invention, which is described and claimed in this specification, consists in the application of a spring of peculiar construction to saddle girths, draw bars, the shrouds or standing rigging of ships, and to chain cables, for the purpose of giving them a certain amount of elasticity; (although, by-the-by, we have hitherto been taught to imagine that the shrouds of a ship should always be as taut as possible, and that if any lateral play were given to the mast, it would be pretty sure to go by the board in the first heavy gale of wind.)

WILLIAM EDWARD NEWTON, Chancery-lane, civil engineer. *For improvements in machinery or apparatus for making hat bodies and other similar articles.* (A communication.) Patent dated January 29, 1850.

The hair of which hat bodies are made is pressed on a "former" by means of atmospheric pressure. The "former" is a perforated cone of thin sheet metal, from the inside of which the air is exhausted by a fan placed below it, and in the framework which supports it. The former is made to rotate in front of the mouth of a trough that supplies the hair. It is made with a moveable top and with flexible metallic sides, to allow of the discharge-opening being enlarged or contracted, as required, for depositing the hair thicker on some parts of the former than in others. In the rear end of the trough is a rotary brush, and two feed-rollers which take the hair from an endless band on the outside, and supply it to between the rotary brush and other rollers supported in the lower part of that end of the trough, in which there is also an adjustable valve to regulate the admission of air. The combined action of the brush and rollers serves to straighten the hair, which is subsequently carried into the former by the current of air created by the revolution of the brush, where it is retained by reason of the unbalanced pressure of the atmosphere. When sufficient hair has been deposited, a felt or fulled cloth is placed upon the hair—the action of the machine still continuing—to retain it in position while the "former" is removed from the frame and immersed in water.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Rodolphe Helbranner, of Regent-street, Middlesex, for improvements in preventing the external air, and dust, and noise, from entering apartments. July 31; six months.

Thomas Dickason Rotch, of Drumlamford House, Ayr, W. B., Esq., for an improved mode of manufacturing soap. July 31; six months.

Matthew Trattles, of Rochester, Kent, toolmaker, for certain improvements in saw-sets, mallets, and other tools, and in apparatus and machinery for manufacturing the same. July 31; six months.

John Sheafe Gaskin, jun., of the Island of Barbadoes, in the West Indies, gent., for improvements in the manufacture of rum. To extend to the colonies only. July 31; two months.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of 166, Fleet-street, London, Patent-agents, for an improvement or improvements in abdominal supporters. July 31; six months. A communication.

James White, of Holborn, Middlesex, mill-maker, for improvements in machinery for bruising, crushing, and for expressing juice from certain vegetable substances. July 31; six months.

Henry Bessemer, of Baxter House, St. Pancras-road, Middlesex, engineer, for certain improvements in apparatus acting by centrifugal force, in the manufacture of sugar, and other improvements in the treatment of saccharine matter by such apparatus. July 31; six months.

Juan Nepomuceno Adorno, of Golden-square, Middlesex, gent., for improvements in manufacturing cigars and other similar articles. July 31; six months.

Henry Rishton, of Kendal, Westmoreland, plumber, for certain improvements in water-closets and urinals. July 31; six months.

Joseph Poole Pirsson, civil engineer, New York, America, for certain improvements in steam machinery and apparatus connected therewith. July 31; six months.

John Hynam, of Princes-square, Finsbury, Middlesex, chemical-light manufacturer, for improvements in machinery for placing splints of wood, and wax, and composition tapers, in frames for dipping. July 31; six months.

John James Greenough, of George-street, Hanover-square, gent., for improvements in obtaining and applying motive power. July 31; six months.

Peter Fairbairn, of Leeds, York, machinist, and John Hetherington, of Manchester, for certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton, flax, and other fibrous substances; also in constructing and applying models or patterns for moulding, preparatory to casting parts of machinery employed in preparing, spinning, and manufacturing fibrous substances; and also in certain tools to be used in making such machinery. July 31; six months.

Matthew Gray, of Morris-place, Glasgow, practical engineer, for an improved method of supplying steam-boilers with water.

Edouard Gabriel Leroy, of Paris, France, gent., for certain improvements in locomotive engines, and in the means and apparatus to be employed for generating and condensing the steam to be used therein. July 31; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
July 26	2388	John Wright	Sheffield	Tempering and straightening plates.
„	2389	Andrew Campbell	Tottenham-court-road	Argyll bouquet-holder and watch-protector.
27	2390	Samuel Perkes	Birkenhead	Metallic folding bedstead.
„	2391	George Boulton	Great Dover-street, Southwark	Chrosha (or crochet) and tambour hook.
29	2392	Henry Broadhead	Leeds	Flat whitening-brush.
30	2393	Joseph Mackenzie	Bideford, Devon	"The Cheirosthenicon," — an instrument calculated to give strength and flexibility to the fingers, and to communicate the equality of touch so essential to correct and brilliant execution on the pianoforte.
31	2394	James Thornton and Sons	Birmingham	Signal lamp.

CONTENTS OF THIS NUMBER.

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Edited by J. C. Robertson, 166, Fleet-street.

BEATSON'S PATENT INSTRUMENTS FOR TAKING, MEASURING, AND COMPUTING ANGLES.

Fig. 1.

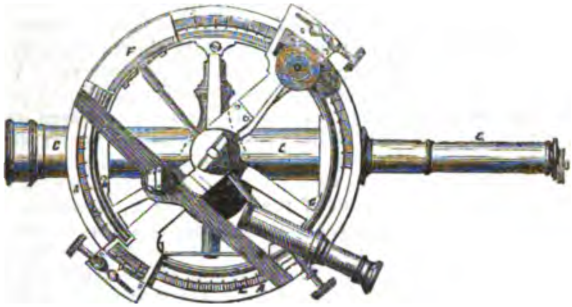


Fig. 2.

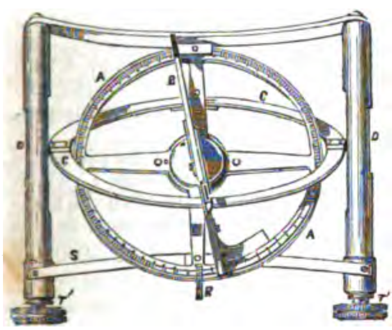


Fig. 3.

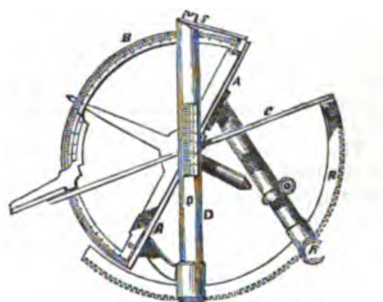


Fig. 4.

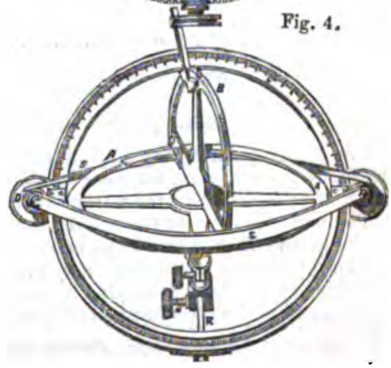
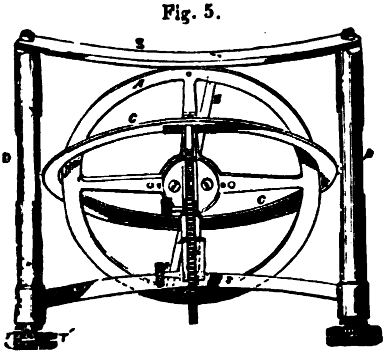


Fig. 5.



BEATSON'S PATENT INSTRUMENTS FOR TAKING, MEASURING, AND COMPUTING ANGLES.—(SEE ANTE P. 98.)

The Universal Altimeter.

Fig. 1 is a side elevation of this instrument. A is a broad ring of brass, to one side or the back of which a telescope, C, is affixed in a horizontal line exactly coinciding with the centre of the ring. B is a glass tube of about the sixteenth of an inch in the bore, which is let into a groove made in the front of the ring, and extends all round with the exception of about an inch or two, where a segmental air-tight junction piece, F, of metal is inserted between the two ends of the tube, which are left open, and communicate freely with the piece F. The tube is about half filled with mercury (or other suitable fluid) which forms itself into a continuous thread of a crescent shape, with a fixed quantity of air between the two cusps. As long as the two fluids are left at liberty, they may of course be shifted round to any parts of the circle; but in the middle of the junction-piece F, there is a valve V (not seen in the figure) inserted, which is worked by a spindle E and thumb-piece E′, from the opposite side of the instrument; and when this valve is closed, the motion of the fluid to either side of that valve is from that moment necessarily stopped. The eye-piece of the telescope is provided with darkened glasses, to save the eye from the glare of the sun, and the field of view is divided in the centre by a wire, to show the line of collimation. On the front of the brass ring A, immediately outside of the groove containing the glass tube, and on opposite sides of the telescope, there are two quarter circle scales, R and L, engraved. Both of these scales have their zero points on the same line with the axial line of the telescope, but the numbers in R run upwards from 0 to 90, while those in L run downwards from 0 to 90; the 90° in the one case (R) representing the zenith and in the other the nadir. These scales are subdivided by two verniers DD. The mode of using the instrument is as follows: The observer first releases the alcoholic or other fluid in the tube B from the pressure of the columns of air at each end by turning the thumb-piece E′ from left to right; he then directs the telescope towards the sun or other object whose altitude it is desired to ascertain, and brings the cross-wire into contact (so to speak) therewith; which having done, he turns the thumb-piece E′ the reverse way, which fixes the mercury at the exact level it had attained at the moment of contact, the column of air in B pressing on the mercury at each end, and thus necessarily preventing the slightest displacement.

The observer next proceeds to read off the indications furnished by the two scales of the instrument; he sets first down the numbers on the left-hand scale L, which come opposite to the top line of the fluid on the left-hand side, and then the numbers opposite the top line of the fluid on the right-hand side; which done, he adds the two sets of numbers together, and divides by 2, which gives the required altitude.

For example; if the

Left altitude be	46° 20′
Right altitude	47° 40′
The sum divided	2)94°
Would give for the desired altitude....	47°

The necessity for taking a mean of the two readings arises from the liability of the fluids to expansion, for were no change to take place in their thermometric condition after the contact, the numbers would remain necessarily alike on both sides.

The better to show to the eye the movements of the fluids in the tube, the bottom of the groove G may be stained of a red or some other bright colour.

The "Universal Altimeter" may be contained in one framework with any of the ordinary sea and land surveying instruments; as is exemplified in fig. 1, where it is shown combined with a common sextant.

Instrument for Finding the Latitude and Apparent Time.

Fig. 2 is a front elevation of this instrument; fig. 3 an end view; fig. 4 a top plan;

and fig. 5 a back elevation. A is a circle, graduated into hours, minutes, and seconds, which may be adjusted to any elevation by a rack and pinion R. B is a moveable quadrant or vernier, also graduated into hours, minutes, and seconds, which is mounted on the face of and at right angles to A. D D are two vertical bars, which are attached by curved stays S S, at an angle of 66° 30′, to the sides of the hour circle A, and are divided into minutes and seconds up and down from a common zero in the centre. C is a ring which is divided, like A, into hours, minutes, and seconds, and is slid up and down the vertical bars D D by means of the spindles T and thumb-pieces T^1. In using this instrument, the observer first takes an altitude, and then finds the apparent time on board ship, after which he reduces the declination to the apparent time. He then sets the ring C to the same declination, turns round the moveable quadrant or vernier D until it corresponds with the time, upon which he raises the ring C to the true altitude, and having fixed it there, turns the quadrant or vernier round to 12 o'clock, and reads off the increased altitude, which gives the true meridian altitude. To find the apparent time in the preceding operation, the observer should first take the latitude by account at noon, and set it to the meridian altitude; then reduce the declination to the approximate time and take an altitude; next turn the quadrant round until the altitude cuts the arc, when opposite thereto will be found the apparent time, as also the sun's bearing.

THE "ELECTRICAL EXPERIMENT."*

Sir,—I read with much interest the "Electrical Experiment," recorded by a Romford correspondent in your Magazine for July the 27th. A variety of experiments suggested themselves as likely to explain the cause of the phenomenon; I have not, however, found time to carry any of them out until late last night. I forward you the results of the most decisive, without delay.

My apparatus consisted of a single pint cell of Smee's battery, charged with a solution 1 part sulphuric acid to 8 of water, and a good electro-magnetic coil machine, with *primary* and *secondary* coils of the length usually employed for medical purposes, and a vibrating contact-breaker.

Experiment 1.—Upon setting the apparatus to work, a copper wire was applied to one extremity of a bundle of soft iron wires inserted within the hollow of the reel, the other end being held in the hand;—a stream of minute sparks appeared in the dark at the point of contact.

Exp. 2.—Upon uniting the two ends of the secondary coil, the sparks altogether ceased.

Exp. 3.—Again disconnecting the ends, and repeating experiment 1, standing upon a glass-legged stool, no sparks could be produced.

Exp. 4.—Upon touching the extremities of the soft iron bundle with a wire connected with the *outer* end of the secondary coil, a stream of sparks passed of much greater brilliancy than in the former cases.

Exp. 5.—Connecting the touching wire with the *inner* end of the same coil, the sparks ceased.

These results are, I think, sufficient to disprove the development by induction of electricity in the bundle of wires; as the spark may, in each case, be attributed to the passage of the electricity of the secondary coil, from the inner to the outer extremity, by the shortest available path through imperfect conductors, when no direct communication is established. The absence of the sparks in the other experiments would lead to the same conclusion. Their brightness is so much diminished by placing the bundle of wires within a glass tube in the reel, that I can only attribute those which do still pass, to imperfection in the insulation.

I have carefully tested the wires with a delicate electrometer, but there is no indication of the presence of free electricity.

I am, Sir, yours, &c.,

G. E. D.

P.S.—Your correspondent attributes the discovery of electro-magnetism to

* *Mech. Mag.*, vol. liii., p. 72.

Professor Orsted. Arago was, I believe, the first to produce a soft iron "electro-magnet."

Aug. 1, 1850.

RETROSPECT OF THE PROGRESS OF ASTRONOMY.

[From the Inaugural Address of the President (Sir David Brewster) of the Edinburgh Meeting of the British Association, August, 1850.]

Astronomy is a study which has made great progress under the patronage of this Association—a subject, too, possessing a charm above all other subjects, and more connected than any other with the deepest interests, past, present, and to come, of every rational being. It is upon a planet that we live and breathe. Its surface is the arena of our contentions, our pleasures, and our sorrows. It is to obtain a portion of its alluvial crust that man wastes the flower of his days, and prostrates the energies of his mind, and risks the happiness of his soul; and it is over or beneath its verdant turf that his ashes are to be scattered or his bones to be laid. It is from the interior, too—from the inner life of the earth that man derives the materials of civilization—his coal, his iron, and his gold. And deeper still, as geologists have proved—and none with more power than the geologists around me—we find in the bosom of the earth written on blocks of marble—the history of primæval times, of worlds of life created and worlds of life destroyed We find there, in hieroglyphics as intelligible as those which Major Rawlinson has deciphered on the slabs of Nineveh, the remains of forests which waved in luxuriance over its plains—the very bones of huge reptiles that took shelter under their foliage, and of gigantic quadrupeds that trod uncontrolled its plains, the law-givers and the executioners of that mysterious community with which it pleased the Almighty to people his infant world. But though man is but a recent occupant of the earth, an upstart in the vast chronology of animal life, his interest in the Paradise so carefully prepared for him is not the less exciting and profound. For him it was made, he was to be the lord of the new creation, and to him it especially belongs to investigate the wonders it displays, and to learn the lesson which it reads. But while our interests are thus closely connected with the surface and the interior of the earth, interests of a higher kind are associated with it as a body of the solar system to which we belong. The object of Geology is to unfold the history and explain the structure of a planet; and that history and that structure may, within certain limits, be the history and the structure of all the other planets of the system—perhaps of all the other planets of the universe. The laws of matter must be the same wherever matter is found. The heat which warms our globe radiates upon the most distant of the planets, and the light which twinkles in the remotest star is, in its physical, and doubtless in its chemical properties, the same that cheers and enlivens our own system; and if men of ordinary capacity possessed that knowledge which is within their reach, and had that faith in science which its truths inspire, they would see in every planet around them, and in every star above them, the home of immortal natures—of beings that suffer and of beings that rejoice—of souls that are saved and of souls that are lost. Geology is, therefore, the first chapter of astronomy. It describes that portion of the solar system which is nearest and dearest to us,—the cosmopolitan observatory, so to speak, from which the astronomer is to survey the sidereal universe, where revolving worlds and systems of worlds summon him to investigate and adore. There, too, he obtains the great base lines of the earth's radius to measure the distances and magnitudes of the starry host, and thus to penetrate by the force of *reason* into those infinitely distant regions where the imagination dare not follow him. But Astronomy, though thus sprung from the earth, seeks and finds, like Astræa, a more congenial sphere above. Whatever cheers and enlivens our terrestrial paradise is derived from the orbs around us. Without the light or heat of our sun, and without the uniform movements of our system, we should have neither climates nor seasons. Darkness would blind and famine destroy everything that lives. Without influences from above, our ships would drift upon the ocean, the sport of wind and wave, and would have less security for reaching their destination than balloons floating in the air and subject to the caprice of the elements. But while the study of Astronomy is essential to the very existence of social life, it is instinct with moral influences of the highest order. In the study of our own globe we learn that it has been rent and upheaved by tremendous forces—here sinking into ocean depths, and there rising into gigantic elevations. Even now, Geologists are measuring the rise and fall of its elastic crust; and men who have no faith in science often learn the truth to their cost, when they see the liquid fire rushing upon them from the volcano, or stand above the yawning crevice in which the earthquake threatens to overwhelm them. Who can say that there is a limit to agencies

like these? Who could dare to assert that they may not concentrate their yet divided energies, and rend in pieces the planet which imprisons them? Within the bounds of our own system, and in the vicinity of our own earth, between the orbits of Mars and Jupiter, there is a wide space which, according to the law of planetary distances, ought to contain a planet. Kepler predicted that a planet would be found there—and strange to say, the astronomers of our own times discovered at the beginning of the present century four small planets, Ceres, Pallas, Juno, and Vesta, occupying the very place in our system where the anticipated planet ought to have been found. Ceres, the first of these, was discovered by Piazzi, at Palermo, in 1801; Pallas, the second of them, by Dr. Olbers, of Bremen, in 1802; Juno, the third, by Mr. Harding, in 1804; and Vesta, the fourth, by Dr. Olbers, in 1807. After the discovery of the third, Dr. Olbers suggested the idea that they were the fragments of a planet that had been burst in pieces; and, considering that they must all have diverged from one point in the original orbit, and ought to return to the opposite point, he examined these parts of the heavens, and thus discovered the planet Vesta. But though this principle was in the possession of astronomers, nearly forty years elapsed before any other planetary fragment was discovered. At last, in 1845, Mr. Hencke, of Driessen, in Prussia, discovered the fragment called Astræa, and, in 1847, another, called Hebe. In the same year our countryman, Mr. Hind, discovered other two, Iris and Flora. In 1848 Mr. Graham, an Irish astronomer, discovered a ninth fragment, called Metis. In 1849 Mr. Gasparis, of Naples, discovered another, which he calls Hygeia; and within the last two months, the same astronomer has discovered the eleventh fragment, to which he has given the name of Parthenope. If these eleven small planets are really the remains of a larger one, the size of the original planet must have been considerable. What its size was, would seem to be a problem beyond the grasp of reason. But human genius has been permitted to triumph over greater difficulties. The planet Neptune was discovered before a ray of its light had entered the human eye; and by a law of the solar system just discovered, we can determine the original magnitude of the broken planet long after it has been shivered into fragments,—and we might have determined it even after a single fragment had proved its existence. This law we owe to Mr. Daniel Kirkwood, of Pottsville, a humble American, who, like the illustrious Kepler, struggled to find something new among the arithmetical relations of the planetary elements. Between every two adjacent planets there is a point where their attractions are equal. If we call the distance of this point from the sun the radius of a planet's sphere of attraction, then Mr. Kirkwood's law is, that in every planet the square of the length of its year, reckoned in days, varies as the cube of the radius of its sphere of attraction. This law has been verified by more than one American astronomer; and there can be no doubt, as one of them expresses it, that it is at least a physical fact in the mechanism of our system. This law requires the existence of a planet between Mars and Jupiter; and it follows from the law that the broken planet must have been a little larger than Mars, or about 5,000 miles in diameter, and that the length of its day must have been about 57½ hours. The American astronomers regard this law as amounting to a demonstration of the nebular hypothesis of Laplace; but we venture to say that this opinion will not be adopted by the astronomers of England. Among the more recent discoveries within the bounds of our own system, I cannot omit to mention those of our distinguished countryman, Mr. Lassels, of Liverpool. By means of a fine 20-feet reflector, constructed by himself, he detected the satellite of Neptune, and more recently an eighth satellite circulating round Saturn —a discovery which was made on the very same day by Mr. Bond, director of the Observatory of Cambridge, in the United States. Mr. Lassels has still more recently, and under a singularly favourable state of the atmosphere, observed the very minute, but extremely black, shadow of the ring of Saturn upon the body of the planet. He observed the line of shadow to be notched, as it were, and almost broken up into a line of dots; thus indicating mountains upon the plane of the ring—mountains doubtless raised by the same internal forces and answering the same ends as those of our own globe. In passing from our solar system to the frontier of the sidereal universe around us, we traverse a gulf of inconceivable extent. If we represent the radius of the solar system, or of Neptune's orbit (which is 2,900 millions of miles) by a line two miles long, the interval between our system, or the orbit of Neptune, and the nearest fixed star will be greater than the whole circumference of our globe—or equal to a length of 27,600 miles. The parallax of the nearest fixed star being supposed to be one second, its distance from the sun will be nearly 412,370 times the radius of the earth's orbit, or 13,746 times that of Neptune, which is thirty times as far from the sun as the earth. And yet to that distant zone has the genius of man traced the Creator's arm working the wonders of his power, and diffusing the gifts of

his love—the heat and the light of suns—the necessary elements of physical and intellectual life. It is by means of the gigantic telescope of Lord Rosse that we have become acquainted with the form and character of those great assemblages of stars which compose the sidereal universe. Drawings and descriptions of the more remarkable of these nebulæ, as resolved by this noble instrument, were communicated by Dr. Robinson to the last meeting of the Association; and it is with peculiar satisfaction that I am able to state that many important discoveries have been made by Lord Rosse and his assistant, Mr. Stoney, during the last year. In many of the nebulæ the peculiarities of structure are very remarkable, and, as Lord Rosse observes, "seems even to indicate the presence of dynamical laws almost within our grasp." The spiral arrangement, so strongly developed in some of the nebulæ, is traceable more or less distinctly in many; but "more frequently," to use Lord Rosse's own words, "there is a nearer approach to a kind of irregular, interrupted, annular disposition of the luminous material, than to the regularity observed in others;" but his Lordship is of opinion that those nebulæ are systems of a very similar nature, seen more or less perfectly, and variously placed with reference to the line of sight. In re-examining the more remarkable of these objects, Lord Rosse intends to view them with the full light of his six-feet speculum, undiminished by the second reflexion of the small mirror. By thus adopting what is called the *front view*, he will doubtless, as he himself expects, discover many new features in those interesting objects. It is to the influence of Lord Rosse's example that we are indebted for the fine reflecting telescope of Mr. Lassel, of which I have already spoken; and it is to it also that we owe another telescope, which, though yet unknown to science, I am bound in this place especially to notice. I allude to the reflector recently constructed by Mr. James Nasmyth, a native of this city, already distinguished by his mechanical inventions, and one of a family well known to us all, and occupying a high place among the artists of Scotland. This instrument has its great speculum 20 feet in focal length, and 20 inches in diameter; but it differs from all other telescopes in the remarkable facility with which it can be used. Its tube moves vertically upon hollow trunnions, through which the astronomer, seated in a little observatory, with only a horizontal motion, can view at his ease every part of the heavens. Hitherto, the astronomer has been obliged to seat himself at the upper end of his Newtonian telescope; and if no other observer will acknowledge the awkwardness and insecurity of his position, I can myself vouch for its danger, having fallen from the very top of Mr. Ramage's 20 feet telescope when it was directed to a point not very far from the zenith. Though but slightly connected with astronomy, I cannot omit calling your attention to the great improvement—I may call them discoveries—which have been recently made in *photography*. I need not inform this meeting that the art of taking photographic *negative* pictures upon paper was the invention of Mr. Fox Talbot, a distinguished member of this Association. The superiority of the Talbotype to the Daguerreotype is well known. In the latter the pictures are reverted, and incapable of being multiplied; while in the Talbotype there is no reversion, and a single negative will supply a thousand copies, so that books may now be illustrated with pictures drawn by the sun. The difficulty of procuring good paper for the negative is so great, that a better material has been eagerly sought for; and M. Niepce, an accomplished officer in the French service, has successfully substituted for paper a film of albumen, or the white of an egg, spread upon glass. This new process has been brought to such perfection in this city by Messrs. Ross and Thomson, that Talbotypes taken by them and lately exhibited by myself to the National Institute of France, and to M. Niepce, were universally regarded as the finest that had yet been executed. Another process, in which gelatine is substituted for albumen, has been invented, and successfully practised by M. Poitevin, a French officer of engineers; and by an ingenious method which has been minutely described in the weekly proceedings of the Institute of France, M. Edmund Becquerel has succeeded in transferring to a Daguerreotype plate the prismatic spectrum, with all its brilliant colours, and also, though in an inferior degree, the colours of the landscape. These colours, however, are very fugaceous; yet, though no method of fixing them has hitherto been discovered, we cannot doubt that the difficulty will be surmounted, and that we shall yet see all the colours of the natural world transferred by their own rays to surfaces both of silver and paper. But the most important fact in photography which I have now to mention, is the singular acceleration of the process discovered by M. Niepce, which enables him to take the picture of a landscape illuminated by diffused light, in a single second, or at most in two seconds. By this process he obtained a picture of the sun on albumen so instantaneously, as to confirm the remarkable discovery previously made

by M. Arago, by means of a silver plate, that the rays which proceed from the central parts of the sun's disc have a higher photogenic action than those which issue from its margin. This interesting discovery of M. Arago is one of a series on photometry which that distinguished philosopher is now occupied in publishing. Threatened with a calamity which the civilised world will deplore—the loss of that sight which has detected so many brilliant phenomena and penetrated so deeply into the mysteries of the material world, he is now completing, with the aid of other eyes than his own, those splendid researches which will immortalize his own name and add to the scientific glory of his country.*

It has been long known, both from theory and in practice, that the imperfect transparency of the earth's atmosphere, and the unequal refraction which arises from differences of temperature combine to set a limit to the use of high magnifying powers in our telescopes. Hitherto, however, the application of such high powers was checked by the imperfections of the instruments themselves; and it is only since the construction of Lord Rosse's telescope that astronomers have found that, in our damp and variable climate, it is only during a few days of the year that telescopes of such magnitude can use successfully the high magnifying powers which they are capable of bearing. Even in a cloudless sky, when the stars are sparkling in the firmament, the astronomer is baffled by influences which are visible; and while new planets and new satellites are being discovered by instruments comparatively small, the gigantic Polyphemus lies slumbering in his cave, blinded by thermal currents more irresistible than the firebrand of Ulysses. As the astronomer, however, cannot command a tempest to clear his atmosphere nor a thunderstorm to purify it, his only alternative is to remove his telescope to some southern climate, where no clouds disturb the serenity of the firmament, and no changes of temperature distract the emanations of the stars. A fact has been recently mentioned, which entitles us to anticipate great results from such a measure. The Marquess of Ormonde is said to have seen from Mount Etna, with his naked eye, the satellites of Jupiter. If this be true, what discoveries may we not expect, even in Europe, from a large reflector working above the grosser strata of our atmosphere? This noble experiment of sending a large reflector to a southern climate has been but once made in the history of science. Sir John Herschel transported his telescopes and his family to South Africa, and during a voluntary exile of four years' duration he enriched astronomy with many splendid discoveries. Such a sacrifice, however, is not likely to be made again; and we must, therefore, look to the aid of Government for the realization of a project which every civilised people will applaud, and which, by adding to the conquests of science, will add to the glory of our country.

* Full details of the experiments of M. A. Poitevin and Niepce, referred to in the preceding passage, will be found in subsequent articles of our present No.—Ed. M.M.

PHOTOGRAPHY ON GELATINE:—MEANS OF OBTAINING VERY CLEAR AND VERY TRANSPARENT NEGATIVE PROOFS, CAPABLE OF BEING TRANSFERRED A GREAT MANY TIMES ON ORDINARY PHOTOGRAPHIC PAPER. BY M. A. POITEVIN.*

In order to prepare the layer of gelatine on which I make my negative proof, I dissolve in 100 grammes of water 6 grammes of gelatine of good quality (that which is met with in commerce, and which is used for preparing jellies for food succeeded best). This size should not contain salts soluble in water; it should also be as free as possible from fatty matters. To make the solution, I steep the gelatine in distilled water for 10 or 15 minutes; I slowly heat over a spirit lamp, and agitate continually until the solution is complete. If any scum forms, I carefully remove it by means of blotting paper, which I draw over the surface; I strain it through a very fine cloth, previously damped, and I again skim the surface on which a few striæ form, arising, doubtless, from fatty matters which escape the first skimming.

The gelatine being thus prepared, I take, with a graduated pipette, a determinate quantity, and I run it over a very even plate of glass placed horizontally; a layer of $1^{mm}50$ is sufficient; this quantity is equivalent to nearly 20 centimetres of solution for a surfaces of half a plate having 13c·5 or 17c·5. A thicker layer would not be injurious, but a thinner one might present some inconveniences.

Before running the gelatine on the glass plate, a thin layer is applied to it by means of a cloth impregnated with a solution of gelatine, rather more dilute than the foregoing; afterwards, the glass plate is gently heated by means of a spirit-lamp; then the solution of gelatine is run on, and flows uniformly over the plate. The under side of the glass plate is again heated, but with moderation, in order to give fluidity to the gelatine, and is allowed to cool.

* *Comptes Rendus*, No. 21, 27 May, 1850.—*Chemist*, July, 1850.

The plate being thus prepared, I plunge it into a solution of acetate of silver, keeping the surface covered with gelatine underneath, and inclining it in the solution until the latter has completely moistened it; I then turn the glass plate and immerse it completely in the solution; then I pass a very soft pencil several times, and in different directions, all over the gelatinised surface, in order to dispel the bubbles of air which may adhere to it, and, before withdrawing it, I blow on the surface to ascertain whether the solution has moistened it all over. I then remove the plate, and holding it somewhat inclined, I pass the pencil already used over the whole surface, taking care to cover the edge of the previous stroke with that of the following one. I then dry the under side of the plate and place it horizontally until the surface is dry, which requires five or six hours.

I ordinarily prepare over-night the plates which I intend to use on the following morning, and in the morning those which I mean to use in the evening. It is important that no free liquid should be left on the surface of the plate when it is required for use, for the preparation would be removed at the places where any remained. This preparation should be made out of the solar light. The plate covered with the solution of acetate of silver should be kept out of the light.

The solution of acetate of silver is prepared by making a saturated solution of acetate of silver, to which half its bulk of water is added. Admitting that 100 parts of water dissolve, at the ordinary temperature, 0·5 gr. of acetate of silver, to prepare 0·750 lit. of the solution which I use, I dissolve 2·5 gr. of acetate of soda in 15 grammes of water; I likewise dissolve 3·03 gr. of nitrate of silver in 10 grammes of water; I add the solution of nitrate of silver to the solution of acetate of soda, and I receive the acetate of silver which is precipitated on a filter, I wash the precipitate in a stream of water, then I pass through the filter several times 0·50 lit. of water; almost the whole of the acetate of silver should then be dissolved; I afterwards add 0·25 lit. of water to the half litre of saturated solution.

In this operation, 3 grammes of acetate of silver are formed, the 0·75 lit. should contain only 2·50 gr., but I put in a little more of it to make up for any that may have been lost in the water of the solutions and of washing. The acetate of silver being very easily altered by the solar light, I make this solution as far as possible in a dimly lighted place. I preserve it in a bottle covered with black paper, and filter it every time I use it.

I expose the plate prepared as above described to the vapour of iodine, in the same manner as a plate of silvered copper; only, for this exposure, account must be taken of the time, for we cannot judge of the tint on the surface, only the time of exposure is shorter than for silvered plates. The iodised plate is placed in the frame of the camera obscura, and then I cover the side which is not gelatinised with a piece of card-board covered with black cloth. It is good to allow some time to elapse between the iodising and the exposure to the focus of the camera; the plate thereby gains in sensibility. I have sometimes used plates five or six hours after the iodising; they had lost nothing of their sensitiveness.

The sensitiveness of these plates is about one-fourth of that of plates prepared with iodine and bromine. For a landscape with much light and with an object-glass with a small diaphragm, the exposure in the camera may require from 80 to 100 seconds. Portraits, with strong lights and shades, may be taken in two minutes with the portrait object-glass. I have tried the effect of the vapour of bromine on these plates, and have found that it renders them more delicate. I have not made sufficient experiments to have certain data on this subject.

In order to make the image appear, I plunge the plate into a solution of gallic acid containing 0·1 gr. of gallic acid in 100 grammes of water; I leave the proof until the shadows appear sufficiently intense. This immersion may last an hour or an hour and a half. With a more concentrated solution of gallic acid, it would require a shorter time, but it would be more difficult to regulate its action. At the commencement of the immersion, a positive image is formed on the surface of the gelatine. This image becomes more and more dark; but, on looking through it, the parts corresponding to the shadows in nature remain very light.

To fix the proof, it is washed in ordinary water, and then left for about a quarter of an hour in a solution of 1 gramme of hyposulphite of soda in 100 grammes of water; it is again washed in ordinary water, and it is steeped for the same length of time in a solution of 1 gramme of bromide of potassium, in 100 grammes of water.

I wash the proof with ordinary water, allowing it to remain in it for fifteen or twenty minutes; then I wash with distilled water, and allow the layer of gelatine to dry in the open air. It is then a very clear negative proof, capable of giving positive proofs, with ordinary photographic paper, in the sun, in from 2 to 10 minutes, according to the vigour of the negative proof: it also comes very well in the shade.

It is well to renew, at each operation, the solutions of gallic acid, hyposulphite of soda and bromide of potassium.

In this operation, if the solution of gallic acid be replaced by a solution of sulphate of protoxide of iron, very beautiful positive proofs are obtained.

PHOTOGRAPHY ON PAPER. — MEANS OF OBTAINING THE IMAGE IN THE CAMERA OBSCURA ON DRY PAPER.* BY M. BLANQUART-EVRARD.

To render the execution of photography on paper simple, sure and easy to those least experienced in chemical manipulations, should be the object of the efforts of those who wish to bring this art to its most useful application in industrial economy. The first condition for entering into this new order of things, is to rid the operation of the care which it requires at the time of the exposure. We open the way by giving here:—

1. The means of operating on dry paper, instead of damp paper, freeing the operator from the difficult preparations which he has to make at the places of exposure.

2. So simple a mode of preparing this photogenic paper, that it may be manufactured and sold to the amateur who does not desire the trouble of preparing it himself.

The papers prepared by the means hitherto described could not be brought to the dry state without afterwards taking, under the action of gallic acid, an uniform coloration which would efface the photogenic image, and cause it to completely disappear. Serum has the property of obviating this inconvenience; the following is the mode of preparation to be adopted:—

Collect, by filtering, the clear part of milk which has been turned, and beat up in this serum the white of one egg to each pint, then boil in order to remove all the solid matters, and filter again, after which dissolve without heat 5 per cent. by weight of iodide of potassium. The paper to be prepared must be very thick and steeped entirely in the liquid for two minutes, and afterwards dried by hanging it, by means of two pins, by two of its corners, to a line.

This preparation is made in the daylight without any particular precaution; the paper is fit for immediate use for six months after, and certainly after a much longer time. When it has to be used, it is submitted to a second preparation, which is done by candlelight, and as short a time as possible before the exposure; it is, however, still capable of giving good results several days after, avoiding then, as much as possible, leaving it in a high temperature.

We proceed therefore in this preparation by covering a glass with aceto-nitrate of silver composed of 1 part of nitrate of silver, 2 parts of crystallizable acetic acid, and 10 parts of distilled water. On this substance is deposited one of the sides of the paper, which is allowed to imbibe until it has become perfectly transparent, which is ascertained by raising it between the operator's eye and the candle, after which it is dried between several folds of very white blotting-paper, and left so until it has to be placed in the frame, behind a sheet of very clean and dry paper, and between two glasses, as in the moist operation previously described.

The exposure to which we afterwards proceed next day, varies according to the light and the power of the object-glasses, from one to five minutes.

On returning to work, the part of the paper which has been presented to the light is deposited in a saturated layer of gallic acid, taking care to secure the other side from any trace of gallic acid which would stain it. The image is gradually formed, and finally acquires as powerful tones as can be desired; it is then washed in a great quantity of water, then parts into a solution composed of 1 part of bromide of potassium and 20 parts of water, in order to dissolve the unreduced salts of silver, then again washed to remove all traces of this bromide, whose action, by continuing, would destroy the image, and finally dried between folds of blotting paper.

Preparation of the Dry Albuminous Paper.

The paper prepared by albumen has analogous properties to that in the preparation of which serum is used, but in an inferior degree; like it, it remains good for an almost indefinite period after the preparation with the iodide, but, after having been submitted to the aceto-nitrate of silver, it can be scarcely kept beyond next day. The proofs given by the preparation we are about to describe are admirable; not so fine as those on glass, they have more charms, because the contrasts are less decided, and they possess more harmony and softness. We think that it is a real acquisition for those who seek the effects of art in the results of photography.

White of egg, to which have been added thirty drops of a saturated solution of iodide of potassium and two drops of a saturated

* *Comptes Rendus*, No. 21, May 27, 1850.—*Chemist*, July, 1850.

solution of bromide of potassium to each white of egg, is beaten up to a snow. It is left to repose until the snow returns to albumen in the liquid state, and then filtered through silk or clear muslin, the albumen being collected in a large and quite flat vessel. The paper to be prepared is then deposited on the layer and left on it for a few minutes. When it is covered with albumen, it is raised by one of its corners, and allowed to drain and dry by suspending it by one or two corners from a line.

The preparation with the aceto-nitrate is, in every respect, the same as that described for the paper prepared with serum; care must be taken to dry it between two folds of blotting paper only when the paper has acquired complete transparency. It is put into the frame for exposure in the same manner, the appearance of the image and the rest of the operation is the same; but the exposure requires a longer time, generally four or five minutes.

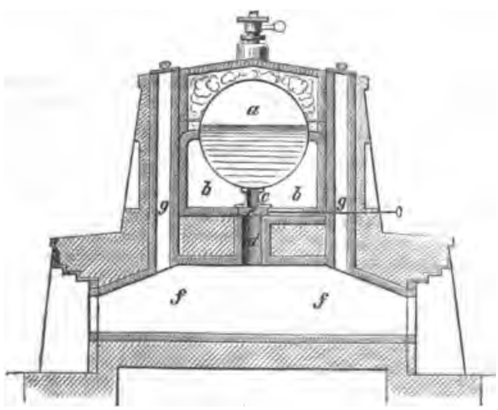
Preparation of the Positive Albumen Paper.

The positive paper prepared with albumen gives somewhat less brilliant proofs, but of a richer tone, and of a more agreeable finish and transparency; it is prepared in the following manner:—

To the whites of eggs is added 25 per cent. (by weight) of water saturated with chloride of sodium. The white of egg is beaten into a snow, and filtered as in the preceding preparation, only in this case the paper is left on the albumen for only half a minute. It is then hung up to dry, which is accomplished in six or eight minutes; it is afterwards deposited in a vessel containing 25 parts of nitrate of silver and 100 parts of distilled water. The paper is left in the bath at least six minutes, and afterwards dried flat.

BELGIAN METHOD OF APPLYING THE HEAT RESULTING FROM THE MANUFACTURE OF COKE TO THE COLLATERAL PURPOSE OF HEATING STEAM-BOILERS.

The application of the heat of coke-ovens to the production of steam is nearly universal in Belgium. It was first used in this way at Couillet, and other works of the Charleroi coal basin. There the flames first passed underneath the coke oven through a series of horizontal flues, whence they were conducted beneath the boilers. But the heat of radiation was not employed in this method. Mr. Matthey, engineer at the Seraing Works, was the first who made use of the heat of radiation of the charged coke oven—thus obtaining a very much larger proportion of heating power. The arrangement adopted at Seraing and Ougrée, which has worked very successfully since, above a year and half, is that represented in section in the accompanying en-



graving:—*a* is the boiler; *b*, the heating flues, which surround it, and which convey the burnt gases into a chimney, placed at the extremity, which chimney rises to a height of about a foot, and is furnished with sliding valves to regulate the draught; *c* is a cast-iron support for the boiler—one of these is placed between each coke oven; *d* is a cylindrical chimney, forming the communication between the coke oven, *f*, and

the flues, *b*; this chimney is covered by a sliding square fire-brick, *e*, which can be drawn backwards and forwards by an iron rod; *g*, *g*, are two vertical chimneys in the thickness of the masonry. Communicating with the coke oven, and closed at top by a moveable brick, there is a small rectangular canal of cast-iron, which conveys the air from the exterior to the superior orifice of the chimney, *d*; this air serves for the purpose of effecting the combustion of the gas, immediately on its exit from the coke oven. Under the boiler is a thin partition wall, running from end to end, so that the flame issuing from the ovens does not immediately go in the direction of the chimney, but flows in the contrary direction till the end, when it turns the partition wall, and is then drawn along the other side of the boiler towards the chimney. Above the boiler is an empty annular space of about 9 or 10 in., where there is an immoveable layer of air, when the heat is required to be concentrated, and a strong draught into the chimney when the boiler is required to be rapidly cooled for cleaning. Under each boiler we have five ovens, which are charged at different stated hours of the day. Each oven is charged with 3 tons 5 cwts. of coal, which remains in the oven 24 hours. The covers over the chimneys, *g*, are closed, and that over *d* is opened. We obtain 10-horses power from each coke oven. When the boiler has to be cleaned out, the slide, *e*, is closed, the chimneys, *d*, are opened, and doors placed in the lateral walls, effecting a communication between the flues, *b*, and the exterior are opened, thereby occasioning a powerful draught into the chimney. The coke ovens proceed as usual. There is a remarkable difference in the earthy deposit in the boilers now to what it was when the boilers were heated in the ordinary manner; then the deposit was so hard and compact, that it had to be broken with a hammer and chisel; now there is not the slightest particle which remains attached to the boilers; it is all in the state of suspended mud, easily removed. I attribute this to the much larger heating surface. The heat on any particular part of the surface is much diminished in intensity. I shall, in a future communication, give some experiments on the quantity of water converted into vapour by the heat produced by the combustion of the gases proceeding from the carbonisation of a given quantity of coal. — E. Montefiore Levi, *Ougrée, Liege.—Mining Journal.*

ON IMAGES OF THE SUN AND MOON OBTAINED ON GLASS BY PHOTOGRAPHY.* BY M. NIEPCE DE SAINT-VICTOR.

Having lately heard M. Arago state at the Academy, that proofs of the sun had been taken on plates of silver, I wished to see the effect produced on a sheet of glass covered with a layer of coagulated albumen, which, as is known, gives an inverse or negative proof.

I operated in the following manner:—Having prepared my glass plate, without employing any means of acceleration, I exposed it in the camera-obscura, of which the object glass (I operated with an object glass for a fourth of the plate) was in the direction of the sun, the image of which I had placed in the visual focus, which in this object glass corresponds exactly to the photogenic focus.

My first experiments were made as quickly as possible, that is to say, as quickly as I could uncover and cover the object glass, operating with a diaphragm of five millimetres in diameter. Notwithstanding this, the image came too rapidly. On submitting the plate to the action of gallic acid, it became quite black. I then conceived the idea of raising the diaphragm and leaving the object glass uncovered long enough for the image to appear without the aid of gallic acid, and this succeeded.

The first plate was exposed five, and the second ten seconds.

These were the results I obtained:—the first plate showed a very visible and distinct image, of a blood-red colour, much deeper in the middle than at the edges, as any one may see by examining the plate.

The second plate presented the same difference between the centre and the circumference, but with greater intensity; besides which, it had a circle beyond the image, in the form of a glory.

The different intensity of the centre and the edge is so much the greater as, notwithstanding the effect of contrast, it is still very perceptible, especially when examined by the microscope. And by the same effect of contrast, if the image is blackened with gallic acid, the reverse effect takes place.

I have made more than twenty proofs, and almost always with the same results.

The results of these experiments are quite in conformity with the opinion announced by M. Arago, that the photogenic rays emanating from the centre of the Sun have more action than those near the edge or circumference.

I tried, and with success, to take the image of the Moon in twenty seconds, the

* *Comptes Rendus*, No. 22, June 3, 1850.

Moon being at the full, and perfectly in the focus of my object glass; and without using an heliostat, I obtained a very round image. But the rapidity with which I operated was so great, that the Moon had not time to move perceptibly; for I should say that if left for thirty seconds we should have rather an oval image.

To obtain an image of the moon, I found it necessary to operate in the speediest manner, such as would enable me to take a proof of a landscape illumined by diffused light in one, or at most two, seconds.

I obtained this great rapidity by new means, which I have lately consigned to the Academy in a sealed packet. This packet likewise contains a means analogous to that which M. Blanquart has just published* for operating in the dry way on paper; I likewise explain the way to prepare paper with albumen for positive proofs. I propose to make these processes known when I have concluded the works with which I am at this moment occupied.

THE ROOFING OF THE BUILDING FOR THE EXHIBITION OF 1851.

Sir,—As I take great interest in all that pertains to the advancement of science, I shall trouble you with a few desultory remarks touching the great covered area in which the Exhibition is to take place next year, and for the completion of which arrangements seem to be already in a very promising state. As it is now understood that the roof of this immense structure is to be of glass, it appears to your correspondent that,—1stly, the annoying effect of a midsummer sun, and the dazzling and heating influence of its noonday rays, has not been sufficiently taken into calculation, as it must be allowed that their effect would be anything but pleasant on the visitors traversing its interior. Also I suspect that some of the sculptural creations, and other works of art, will not in this case be shown to advantage. But secondly, and especially, I would urge that, in case a storm of hail (sufficiently heavy) should unluckily precipitate itself on this brittle mass, how incalculable would be the resulting damage, not merely to the roof, but to the articles collected for exhibition! Without dilating further on the disastrous consequences of such a casualty, I would suggest that the glass roof be completely covered over with some kind of fine network, or else a fabric—as calico, which, besides acting as a cushion to the hail (if such should fall), would also shade off very effectively the rays of the sun. It is not necessary that the fabric should be immediately contiguous to the glass (tiles I will call them), for it can be put at any varying distance from them, either upon slender fixed uprights (similar to the brass railing skirting the counting-house desk), or otherwise—upon stretched cords, or, indeed, any way that would be judged most convenient. I have no doubt that the contractor for the glass will consider the odds of such an accident sufficient in this case to induce him to defray the whole expense out of his own pocket, as the material would be cheap, and would merely want sewing together. Should you consider these suggestions worth recording in your useful Magazine, I shall feel obliged.

I am, Sir, yours, &c.,
WM. H. HALLEN.

Burslem, August, 1850.

WESTMINSTER BRIDGE.

In the *Mech. Mag.* of the 6th ultimo you called the attention of your readers to the laudable exertions of Sir Robert Harry Inglis in procuring the appointment of a Committee of the House of Commons for the purpose of investigating the whole subject of Westminster Bridge, and for carrying out the recommendations of the Report of the Committee of 1848: you also extracted some valuable paragraphs from Sir Howard Douglas's pamphlet on the subject. The Temporary Bridge Committee recently appointed has, it is said, closed its labours by recommending the construction of a temporary bridge, at a cost of 35,000*l.* or 40,000*l.*, and rebuilding the old bridge. After the large sums expended (220,000*l.*) in repairing the old bridge, it was not reasonable to suppose that the Committee would recommend any other course than rebuilding the bridge. Various plans have been suggested,—such as a bridge of timber, and cast and wrought iron, and stone; but in any case, a style suited to that of the Houses of Parliament seems to be recommended. The evidence which was given in the Report of the Committee in 1848 is decidedly against the adoption of any other mate-

* See page 109.

rial than stone, or of any other style than that suitable to the present advanced state of science, rather than retrograde to the style adopted during the dark ages, when art was little understood. Let us not, therefore, have a Gothic bridge. It is said, however, that the appearance of the Houses of Parliament would be sensibly affected if any other than a Gothicized bridge be built; so that, because the architecture of the Houses of Parliament has been frittered away in small details, and its dignity greatly deteriorated, the science of the age is to be compromised further for the sake of the Houses of Parliament! Under such circumstances it behoves the Legislature to consult its character and dignity by appealing to persons the best qualified by their knowledge and experience to guide them from falling into the errors which have emanated from the selection of a style of architecture unsuited to the representatives of a great nation, and to the advancement of the art of bridge-building. While we boast of the metropolitan bridges of Waterloo, London, and Southwark as unrivalled masterpieces, let us avoid the errors which have been and may be committed in the construction and repairs of Westminster Bridge.

ARCHITECTUS.

P.S.—Blackfriars Bridge is failing fast: the haunches or spandrels of the middle arch show alarming cracks in consequence. The sinking of the adjoining pier on the Surrey side, and the subsidence of the cornice and parapet, are considerable. Barge-loads of stone are being thrown into the river, thus endangering the other piers of the bridge.

WATER-TIGHT BULK HEADS, THE INVENTION OF CAPTAIN SCHANKS.

Sir,—You are aware that on perusal of your Magazine of the 27th ult., I immediately endeavoured to obtain "Steel's Elements of Naval Architecture," referred to by your correspondent "* *," in that Number, but it was only last night that an extract of the book was procured, giving an account of Captain Schanks' vessel, the *Trial;* I hasten to say that it now appears to have been Captain Schanks not General Bentham, who first in this country introduced water-tight bulkheads. I, at the same time, offer my thanks to your Ipswich correspondent for having enabled me to correct a misconception which has so long existed.

That part of Steel's description of the *Trial* which relates to the water-tight bulkheads, is as follows:—"The hold is divided into several compartments, all water-tight, and so contrived that even should a plank or two start at sea in different parts of the vessel, she may afterwards be navigated with the greatest security to any part of the world."

Captain Schanks being thus proved to have been the first introducer of this great improvement, I cannot but express surprise that for the long period of fifty-five years it has remained as it were unknown in the naval department, that Genenral Bentham should never have heard of its having been exhibited in the *Trial*, and that even Steel himself having described the *Trial* should a few pages after, in the same book, p. 177, Third Edition, in speaking of Sir Samuel's experimental vessels, describe his fixed bulkheads, and say, "the idea of such bulkheads may probably have originated with the Chinese or with the ancients;" but making neither reference nor allusion to what he had done in the *Trial*.

It seems most extraordinary that General Bentham should never have heard of the water-tight compartments of the *Trial;* at the time of the construction of the experimental vessels he was in frequent communication with Lord Hugh Seymour, the then principal naval Lord of the Admiralty, as also with Sir Philip Stevens, who had previously been long chief secretary of the Admiralty Board, yet these gentlemen never mentioned the *Trial's* water-tight compartments; and moreover, in 1798, they sanctioned General Bentham's Report to the Committee on Finance, in which his water-tight compartments were particularly spoken of, though certainly not as any *invention* of his—for in truth he always disclaimed the *invention* of this improvement, saying it was a practice of the Chinese of the then present day, as it had been of the ancients.

His experimental vessels were for many years scouted by the greater part of naval and dockyard officers, and by the Navy Board, and even unfair means were resorted to for bringing them into discredit, yet never was it ever hinted

that the water-tight compartments had so recently been exhibited in the *Trial*—a circumstance the more unaccountable, as he had adopted sliding heels in the *Arrow* and *Dart* professedly as the invention of Captain Schanks. Can it be that this gentleman's inventions were even in worse odour than General Bentham's among all who were averse to deviations from established practice, good or bad?

General Bentham could not have had any motive for concealing that water-tight compartments had been introduced in the *Trial*, for he never pretended that they were otherwise than well-known as a Chinese practice to English navigators in the eastern seas, and to many English shipwrights. Indeed, it would well have answered his hope of effecting improvement had he been enabled to quote a previous successful instance of water-tight compartments in an English vessel, devised by an English naval officer. Whenever there was opportunity, General Bentham officially brought to notice, in support of his proposals, instances in which the measures he proposed had been previously employed, as his correspondence with the Admiralty would prove. In fact, it was as much his interest as it was his inclination to exhibit, as far as his knowledge went, any cases in which those things he recommended had already been successfully employed.

It may be supposed that your Ipswich correspondent takes a deep interest in naval architecture: if so, it may be hoped that his endeavours will be exerted to introduce an habitual employment of water-tight compartments in vessels built of wood as well as in iron steamers; for surely the expedient is not the less valuable because it was first adopted by Captain Schanks.

M. S. B.

August 7, 1850.

THE ARISTOCRACY OF ENGLAND v. THE CLAIMS OF SCIENCE AND LITERATURE.

In the course of a recent discussion in the House of Commons, Lord John Russell complained of Mr. Bright's having "represented the aristocracy of England as a class forming a sort of great council, like that of Venice, entirely separated from the great body of the people—*as if its ranks were not continually recruited from the great mass of the people.*" And his Lordship proceeded to animadvert on the subject in these terms: "Members of families which a hundred years ago were amongst the humblest and poorest of the subjects of the Crown in this country, have, by dint of talent—by dint of learning, whether in the profession of the law or the church—by their services in the navy or army, or by other distinguished merits—won their way to the highest honours of the peerage, and formed as proud a portion of the aristocracy as any of the peers." . . . "I not only hold that this supposed distinction is unfounded in fact—not only that it is contrary to all we know of the history of past ages, and of what we see day by day, as will appear from an examination of any list of the peers of England—but I also contend that a belief in its existence would have a mischievous effect, and, instead of strengthening that union of classes in this country, which induces the aristocracy to believe that their fate and welfare is bound up with the welfare of the people, and the people to look upon the aristocracy as the defenders of their rights and privileges, would lead to a war of classes and ranks that would cause the subversion of the constitution, and of the existing state of society. The aristocracy of the country, instead of being desirous to separate themselves from the people, feel that their strength and permanent existence depend on continually receiving fresh accessions from those *who by the highest qualities of mind are able to place themselves on an equality with them.*"

We should be glad to believe all this to be true; but it is so only in a very limited sense. The reader has only to refer, as Lord John suggests, to "any list of the peers of England," to be at once convinced that the charge of exclusiveness at which his lordship has taken offence is but too well founded. He will find in this list many successful soldiers, many fortunate political lawyers, and many mere money-grubbers, whose only claim to a place in the peerage was the possession of enormous wealth; but not *one man of science or literature*—that is to say, not one man who can be said *to have been indebted for his elevation to his scientific or literary attainments.*

So much then for "the highest qualities of mind" being represented in the British peerage.

When, some twenty years ago, Mr. Babbage wrote of the "Decline of Science in England," one of the principal causes to which he attributed this (supposed) decline, was this very exclusion of men of science—an exclusion as immemorial as memorable—from the ranks of the nobility. "Another (remedial) proposal," he said, "has been talked of,—one which it may appear almost ridiculous to suggest in England, *but which would be considered so in no other country*,—it is, to ennoble some of the greatest scientific benefactors of their country. Not to mention political causes, the ranks of the nobility are constantly recruited from the army, the navy, and the bar. Why should not the family of that man whose name is imperishably connected with the steam engine be enrolled amongst the nobility of his country? (Why not, indeed?) In utility and profit, not merely to that country, but to the human race, his deeds may proudly claim comparison even with the most splendid of those achieved by classes so rich in glorious recollections."

DR. SCOFFERN'S METHOD OF DEPURATING SUGAR.—IS IT POISONOUS?

A paper was read on Monday last, in the Chemical Lecture of the British Association (Edinburgh Meeting), by Dr. Scoffern, on his process of depurating sugar, which led to an animated discussion. Dr. Scoffern employs acetate of lead to combine with the albuminous matter, and he afterwards converts the lead employed into a sulphite by the introduction of sulphurous acid. The sulphite of lead is insoluble, therefore it does not pass through the filters, and thus removed from the sugar. Some particles, indeed, will pass through, not amounting, however, it was stated, to the 1500th part of a grain in a pound of sugar; and the question on which discussion arose was, whether the sulphite of lead, being insoluble, is innocuous? It was admitted that, by Dr. Scoffern's process, a much larger quantity of refined sugar is produced; but it was affirmed, on the other hand, that the lead would not be sufficiently extracted to render it harmless. Dr. Gregory strongly supported the innocuous view of the question, and said he had given quantities of the sulphite of lead to dogs, without any injurious effects. Dr. Christison, on the other hand, maintained that, though sulphite of lead is insoluble by most known chemical agents, it is possible that it may be rendered soluble by the fluids of the intestines under the influence of vital action. He said he had known the case of a person who had, for a year, drunk water contaminated by an undetectable portion of lead, without experiencing any bad effects; but, at the end of that period, she was attacked with the symptoms which poisoning by lead invariably produces.

THE INVENTION OF THE TUBULAR BRIDGE.

[*Edinburgh Meeting of the British Association.*]

In the Mechanical Section, an interesting discussion arose on the subject of the party to whom the priority of the discovery of the principle of the tubular bridge should be assigned. The discussion arose in consequence of the President of the Association (Sir D. Brewster) having communicated the substance of a note which he had received from Mons. Jules Guyot, claiming the priority of the invention of the tubular bridge, and contending, it would appear, that English engineers had stolen the idea from him. If engineers should consider the junction of hollow parallelopipeds the same in principle as the tubular bridge of Fairbairn's, then Guyot might have some claim to the invention.

Mr. RANKINE stated, that the late Mr. Andrew Thomson, of Glasgow, so far back as 1840, had constructed hollow girders of boiler plates, between which were formed arches of brick to carry a road over the Pollock and Govan Railway: nor did the invention of the girder lie with him even; it was traceable to some time prior to this period, when such girders had been used to form bridges between blast furnaces at iron works.

Major-General Sir CHARLES PASLEY said, that Mr. Stephenson laid claim to the invention of iron girders, whether great or small, and upon this he rested his claim to the invention of the tubular bridge. He had seen his first idea, which was rejected by the Admiralty, because of its not affording space enough for the navigation of the Strait. His next idea was two oval tubes, resting upon a pillar on the Britannia Rock, through which the road would pass. He believed that up to this time no idea had been formed of a tubular bridge. The next step was the rectangular form, which was shown to be the best, by the experiments of Fairbairn. He thought that the particular form was due to Fairbairn, while he believed the original idea of the tubular bridge to be due to Stephenson.

Sir D. BREWSTER observed, that if Stephenson admits (which he seems to have done) that the invention of the girder was the invention of the tubular bridge, then it certainly did follow that, just as a telescope of a foot long was as much a telescope as that of Lord Rosse's, that the invention was due to Stephenson. He did think, however, that Stephenson had claimed too much; and the risk was, he would get credit for less than was his due.

General C. PASLEY was afraid that Mr. Stephenson may have grasped at too much, and might, in consequence, get credit for less than he was, in his opinion, entitled to.

Dr. ROBINSON remarked, that if the letters arising out of the controversy touching this affair between Stephenson and Fairbairn were to be relied on, he certainly did think that Stephenson had extended his claims too far. It did appear to him (Dr. Robinson), that up to a late period Mr. Stephenson had no idea at all of any other than the tensile force, and that the resistance to a compressive force had not yet entered his mind. His idea of auxiliary chains seemed to indicate as much. The grand idea of a tubular bridge at this time he certainly had not.

The ASTRONOMER ROYAL (Professor Airy) expressed his great regret that a controversy of this kind had been admitted into the British Association. He protested against all discussions of this kind, as being foreign to its objects, and calculated, in no small degree, to disturb the harmony of its deliberations.

Sir D. BREWSTER having been boldly told, when in France, that the idea of the tubular bridge had been stolen by the English, he felt bound to defend his countrymen from such an allegation. He did not see why the discussion could not be conducted in kindness, and with the simple idea of determining the truth. He could not sympathise with the Astronomer Royal in his protest against such discussions being entered upon in the British Association.

Here the discussions were likely to become so warm, that Dr. Robinson, the President of the Section, brought them to a close, much to the regret of many present. —*Daily News.*

THE MAGNET—INQUIRY.

Sir,—I should feel much obliged if some of your readers would, through the medium of your pages, inform a learner in electricity what amount of magnetic power resides in the keeper of a magnet compared with that in the magnet itself, supposing the keeper not to be in actual contact with the permanent magnet, but having the poles of the keeper separated from those of the permanent magnet, about the distance of the thickness of stout paper.

The size of the keeper may be assumed to be in any ratio to that of the magnet that he who will kindly give me an answer pleases. Hoping very soon to have a reply,

I remain to you, and all Electricians,

A FELLOW-WORKER OF SCIENCE.

THE REALITY OF SPECTRAL APPEARANCES PROVED AND TRACED TO NATURAL CAUSES.

(From "Reichenbach's Researches on Magnetism" —Dr. Gregory's Translation.)

A case which occurred in the garden of the blind poet Pfeffel, has been widely circulated by the press, and is well known. I shall here mention so much of it as is essential. Pfeffel had engaged a young Protestant clergyman, of the name of Billing, as amanuensis. The blind poet, when he took a walk, held Billing's arm, and was led by him. One day, as they were walking in the garden, which was at some distance from the town, Pfeffel observed, that as often as they passed over a certain spot, Billing's arm trembled, and the young man became uneasy. He made inquiry as to the cause of this, and Billing at last unwillingly confessed, that as often as he passed over that spot, he was attacked by certain sensations, over which he had no control, and which he always experienced where human bodies lay buried. He added, that when he came to such places at night, he saw strange (*Scotice*, uncanny) things. Pfeffel, with the view of curing the young man of his folly, as he supposed it to be, went that night with him to the garden. When they approached the place in the dark, Billing perceived a feeble light, and when nearer, he saw the delicate appearance of a fiery ghost-like form hovering in the air over the spot. He described it as a female form, with one arm laid across the body, the other hanging down, hovering in an upright posture, but without movement, the feet only a few hand-breadths above the soil. Pfeffel, as the young man would not follow him, went up alone to the spot, and struck at random all round with his stick. He also ran through the spectre, but it neither moved nor changed to Billing's eyes. It was as when we strike with a stick through a flame; the form always appeared again in the same shape. Many experiments were tried during several months; company was brought to the place, but no change occurred; and the ghost-seer adhered to his earnest assertions; and, in consequence of them, to the suspicion that some one lay buried there. At last Pfeffel had the place dug up. At a considerable depth, they came to a firm layer of white lime, about as long and as broad as a grave, tolerably thick; and

on breaking through this, the bones of a human being were discovered. It was thus ascertained that some one had been buried there, and covered with a thick layer of lime, as is usually done in times of pestilence, earthquakes, and similar calamities. The bones were taken out, the grave filled up, the lime mixed up with earth and scattered abroad, and the surface levelled. When Billing was now again brought to the place, the appearance was no longer visible, and the nocturnal ghost had vanished for ever. It is hardly necessary to point out to the reader what I think of this story, which caused much discussion in Germany, because it came to us on the authority of the most trustworthy man alive, and received from theologians and psychologists a thousand frightful interpretations. To my eyes, it belonged entirely to the domain of chemistry, and admitted of a simple and clear scientific explanation. A human corpse is a rich field for chemical changes,—for fermentation, putrefaction, gasification, and the play of all manner of affinities. A layer of dry quick lime, compressed into a deep pit, adds its own powerful affinities to organic matters, and lays the foundation of a long and slow action of these affinities. Rain water from above is added; the lime first falls to a mealy powder, and afterwards is converted, by the water which trickles down to it, into a tallow-like external mass, through which the external air penetrates but slowly. Such masses of lime have been found buried in old ruined castles, where they have lain for centuries; and yet the lime has been so fresh, that it has been used for the mortar of new buildings. The carbonic acid of the air, indeed, penetrates to the lime, but so slowly, that in such a place a chemical process occurs which may last for many years. The occurrence in Pfeffel's garden was therefore quite according to natural laws; and since we know that a continual emanation of the flames of the crystalline force* accompanies such processes, the fiery appearance is thus explained. It must have continued until the affinities of the lime for carbonic acid, and for the remains of organic matter in the bones, were satisfied, and finally brought into equilibrium. Whenever, now, a person approached who was, to a certain degree, sensitive, but who might yet be or appear in perfect health; and when such a person came within the sphere of these physical influences, he must necessarily have felt them by day, like Mlle. Maix, and seen them by night, like Mlle. Reichel. Ignorance, fear, and superstition, would now give to the luminous appearance the form of a human spectre, and supply it with head, arms, and feet; just as we can fancy, when we will, any cloud in the sky to represent a man or a demon. * * *

Thousands of ghost stories will now receive a natural explanation, and will thus cease to be marvellous. We shall even see, that it was not so erroneous or absurd as has been supposed, when our old women asserted, as every one knows they did, that not every one was privileged to see the spirits of the departed wandering over their graves. In fact, it was at all times only the sensitive who could see the imponderable emanations from the chemical change going on in corpses, luminous in the dark. And thus I have, I trust, succeeded in tearing down one of the densest veils of darkened ignorance and human error.

* The author here refers to the luminous emanations which are constantly streaming from magnets and magnetised bodies—a fact long suspected, but only lately established by his researches—and which are visible in the dark to many persons of great optical sensibility, and to a few even in twilight. The aurora borealis is but a case of this phenomenon on a large scale, in which the earth is the emitting magnetic body.—Ed. M. M.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING AUGUST 8TH, 1850.

ALBERT DUMMLER, Mark-lane, London. *For improvements in obtaining fibres from textile plants.* (A communication.) Patent dated January 31, 1850.

This invention consists in subjecting strips of textile plants to the grinding action of two serrated surfaces between which they are placed, and which have either a reciprocating or rotary motion communicated to them by hand, or from any prime mover, whereby, it is stated, the fibres will be separated from the pulpy or other matters with which they are combined. To facilitate this separation, water is to be pumped on to the matters between the grinding surfaces.

No claims are given in this specification.

JAMES TEMPLETON, Glasgow, manufacturer. *For certain improvements in manufacturing figured fabrics principally designed for the production of carpeting.* Patent dated January 29, 1850.

Claims.—1. The manufacture of carpeting, or other figured fabrics, with a coloured pattern or design on one or both sides by means of a printed weft.

2. The manufacture of carpeting or figured fabrics with a party-coloured cut-pile weft from a plain cloth or texture of one colour, and printed in different colours.

THOMAS BURY, Salford, Lancaster, silk,

worsted, and piece dyer and finisher, and Nathan Ramsden, of the same place, calenderman and finisher. *For certain improvements in the construction of machines for glazing, embossing, and finishing woven fabrics and paper.* Patent dated January 31, 1850.

The patentees specify an arrangement and application of two or more friction bowls, rollers, or cylinders, in conjunction with a paper bowl, and also a mode of working one or two pieces of fabric with two or more friction bowls.

Etienne Joseph Hanon Valck, Belgium, miller. *For improvements in grinding.* Patent dated January 31, 1850.

This invention consists in cutting channels or openings in the stone, and adapting to the outer ends of some of them funnels for the purpose of catching the air during the rotation of the stone, and conducting it between the grinding surfaces. To the outer ends of the other channels there are adapted cocks, stoppers, or hood-pieces, for the purpose of regulating the admission of air.

Claim.—The use of funnels in combination with channels or openings cut in the grinding stone.

Thomas Auchterlonie, Glasgow, manufacturer and calico printer. *For improvements in the production of ornamental fabrics.* Patent dated February 7, 1850.

This invention consists in ornamenting fabrics by affixing to their surfaces figures or devices cut out of other fabrics of a different colour and texture. For this purpose a fabric, satin for instance, is pressed under a roller, the periphery of which is engraved according to the desired figures, whereby these figures are cut out, or nearly so. The pieces of satin are afterwards laid on a strip of damp strong calico, with the right side down, and have some suitable composition which melts by heat—by preference gutta percha, dissolved in naphtha—applied to the wrong side. The fabric to be ornamented—say, for example, barege—which is printed with outlines or marks to indicate to the workman where the figure is to be applied, is stretched upon the convex surface of a box, heated internally by steam. The workman then lifts up the device with a pricker, transfers it to the heated surface of the barege, and presses it down with a stamp. Instead of printing indications on the fabric to be ornamented, it may be made to pass under a frame having a number of strings stretching from side to side, and crossing each other at right angles, so as to form a series of squares which may serve to guide the workman in placing the figures.

Claims.—1. The system or mode of ornamenting fabrics by affixing to their surfaces figures or devices, which are in relief, and form wholly or partially the ornamentation thereof.

2. The employment of the rotary cutting-out apparatus.

3. The employment of the guide-frame.

Charles Atherton, Member of the Institution of Civil Engineers, London. *For an improved apparatus or machinery for regulating the admission of steam to the cylinders of steam engines.* Patent dated February 7, 1850.

The patentee describes and claims—

1. A peculiar construction and arrangement of eccentric wheel or crank motion, in order that the throw of the crank may be varied as required. For this purpose, the central portion of the eccentric wheel is cut away and fitted at top and bottom, on the inside, with two screw rods, which carry a plate, through the centre of which passes the centre of motion. By turning the screw rods so as to shift the centre of the plate further from or nearer to the centre of the eccentric wheel, the throw of the crank will be increased or diminished accordingly.

2. Constructing the slide valve of a number of cylindrical or annular surfaces, which are maintained at a certain distance apart from each other. The steam issues through the spaces between the rings, and when they are brought opposite to corresponding spaces in the casing, it passes into the steam cylinder. When the cylindrical surfaces are brought opposite to the openings in the casing, the supply of steam will be cut off.

Edward Highton, Clarence-villa, Regent's-park, Middlesex, engineer. *For improvements in electric telegraphs, and in making telegraphic communications.* Patent dated February 7, 1850.

Mr. Highton describes and claims:

1. An improved mode of arranging the circuit. Two or more signalizing instruments are placed at two or more stations, and to each of them two batteries are connected, so placed in regard to their poles as to work in opposite directions. The electric effect of any one of the batteries may be neutralized by connecting the poles in a short circuit, or by other suitable means, while the other battery remains in the circuit with the rest.

2. A mode of signalizing by means of the absence of the electric current from the wires, so as to dispense with the necessity of batteries, or means of producing electric currents at each station.

3. A method of working electric telegraphs by the inductive influence of electro-magnets, or a voltaic pile acted on by the transmission through it of an electric current.

4. The employment of two currents of electricity, of different powers, to produce two different effects in electric telegraphs.

5. Making the dials, which carry the letters or characters, moveable, instead of the pointers, as hitherto.

6. Repeating the letters which occur the most frequently several times.

7. A method of sounding alarums along a line of telegraphic wire.

8. An arrangement for sounding one out of a number of alarums.

9. The employment of pendulums for making and breaking the electric circuit.

10. The protecting of telegraphic wires by enveloping them in masonry.

11. A method of enclosing telegraphic wires in leaden or other flexible metallic pipes.

12. Enamelling the exterior surface of the gutta percha coating of electric wires, in order to fill up the holes which generally exist therein. He rubs the surface over with naphtha or other solvent, and then smooths it down by a cushion or brush.

13. A peculiar mode of suspending the telegraphic wires in the air.

14. A method of constructing the supporting post, out of a number of planks firmly united together, instead of out of one piece of timber, cut taperingly, as has hitherto been the custom.

15. A mode of working electric telegraphs by means of earth batteries.

16. Removing the atmospheric electricity which is collected during storms, or other atmospheric disturbances, by causing the line wire, or a bar of iron connected thereto, previously enclosed in bibulous paper or other fabric, to pass through a mass of iron filings.

17. The employment of concave, elliptical parabolic surfaces, placed at different stations, for the purpose of collecting signalizing sounds into their foci.

EDWARD ORMEROD, Manchester, mechanical draughtsman, and JOSEPH SHEPHERD, Charlton-upon-Medlock, mechanical engineer. *For improvements in or applicable to apparatus for changing the position of carriages on railways.* Patent dated February 7, 1850.

The patentees describe and claim:

1. A truck for shifting a railway carriage from one line of rails to another, which consists of a frame mounted on wheels that run on a cross line of rails, and carry an inclined oscillating frame, to the top of which are attached two lines of rails. These rails are cut away on the under side, so that they may rest upon the permanent rails, and form as it were a continuation of them. Underneath each end of the oscillating frame there is a set of wedges, which, when pushed out, raise that end of the frame and depress the other on to the permanent line of rails. The two sets of wedges are connected together so that when one is pushed out the other will be drawn back. When it is desired to effect the removal of a railway carriage, the truck is brought into position, and the near end of the oscillating frame depressed until its rails rest upon those of the permanent way. The carriage is then pushed up and secured on the top of the oscillating frame, which is then brought into a horizontal position, upon which the truck is wheeled to the next line of rails, on to which the carriage is allowed to run down.

2. A moveable set of rails, which may be brought by hand over the permanent ones, but will, when no longer wanted, retire into their first position out of the way by the action of a weighted lever. The top surfaces of the rails are sloped upwards, so that one end may rest upon and appear to be an inclined continuation of the permanent rails, while the other end will abut against and be on a level with the top surface of the ordinary shifting truck.

PROCESS OF ENGRAVING UPON IVORY.

The process used to cover ivory with ornaments and designs in black consists in engraving in the ivory itself, and then filling in the designs with a black hard varnish.

To obtain finer and more regular designs, the ivory is to be covered with the common ground, and by means of the point the designs are engraved upon it. They are then eaten in by a solution formed as follows:

Fine silver	6	grammes.
Nitric Acid	30	,,
Distilled Water	125	,,

At the end of about a half-hour, according to the depth to be given, it is to be washed with distilled water, and dried with bibulous paper. The design is then exposed for an hour to the solar light, and the layer of wax is removed by essence of turpentine.

The design has then a black colour or a dark brown, which blackens entirely at the end of one or two days. Other colours may be produced, by replacing the solution of nitrate of silver by a solution of gold or platina in aqua regia, or of copper in nitric acid.—*Révue Scientifique*, xxxv. p. 433.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Joseph Shaw, of Paddock, near Huddersfield, York, cloth finisher, for improvements in constructing and working certain parts of railways. August 3; six months.

John Gwynne, of Landsdowne Lodge, Notting-hill, merchant, for improvements in obtaining motive power, and in applying the same to giving motion to machinery. (Being a communication.) August 5; six months.

Francis Kane, of Berner's-mews, Middlesex, chair maker, for improvements in reclining chairs, in castors for chairs and other articles of furniture, and improvements in presses. August 5; six months.

William Crosskill, of Beverley, York, civil engineer, for improvements in mills for grinding, splitting, pulverising, and crushing grain, bones, bark, ore, and other hard substances, and for grinding paint and other soft substances, and for shelling or removing the skin from rice and other grain, and in machinery for giving rotary motion to mills, thrashing machines, and any other machine requiring rotary motion to be communicated by any horse or other animal. (Being a communication.) August 6; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Aug. 2	2395	John Sanders	Birmingham	Set of dies for making pressed hinges.
,,	2396	William Palmer	Sutton-street, Clerkenwell	Candle-lamp.
3	2397	John Goode, Jun.	Birmingham	Swivel.
,,	2398	William Palmer	Brighton	Sculptor's, statuary's, and medeller's revolving table.
6	2399	John Martin	Killyleagh Mills, Down, Ireland	An arrangement of steam and water pipes to be applied in spinning flax, tow, and other fibrous substances.
7	2400	Robert Davies	Globe-yard, South Molton-street	A pipe mount.
8	2401	George Cart and Sons	Union-street, Southwark	Spring folding collegian cap.
,,	2402	Joseph Welch and John Margetson	Cheapside	Folding trencher cap.

CONTENTS OF THIS NUMBER.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1410.] SATURDAY, AUGUST 17, 1850. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. DONKIN AND FAREY'S IMPROVEMENTS IN STEAM ENGINES.

Fig. 1.

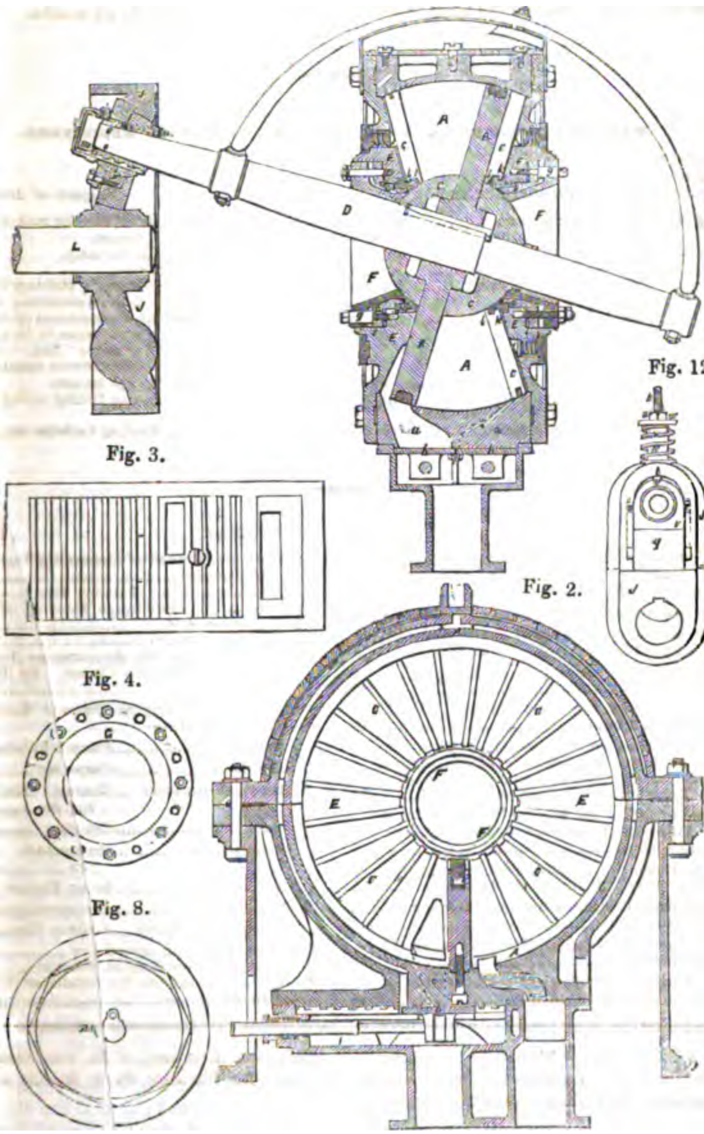


Fig. 3. Fig. 12. Fig. 2. Fig. 4. Fig. 8.

MESSRS. DONKIN AND FAREY'S IMPROVEMENTS IN STEAM ENGINES.

(Patent dated February 9, 1850. Specification enrolled August 9, 1850.)

Specification.

Firstly. Our specification has reference to that description of steam engines commonly called the "Disc Engine," which engine formed the subject matter of the four several patents for England following; namely, a patent granted to Henry Davies, of Stoke Prior, on or about the 15th day of March, 1837; another patent granted to the same Henry Davies, on or about the 14th day of June, 1838; another patent granted to the same Henry Davies, on or about the 15th day of July, 1844; and a patent granted to George Daniell Bishopp, of Edgbaston, on or about the 2nd day of October, 1845, of which four patents respectively specifications were duly enrolled, containing (one or other of them) a full description of the original construction of the said disc engine, and of the different improvements which have been subsequently and heretofore made therein. Our invention, in so far as it regards the said disc engine, consists, in the first place, of certain improved methods or means of making the working parts thereof steam-tight, and an improved method of forming the bearing for the coned end of the diagonal shaft.

Fig. 1 is a longitudinal section through or near the centre of a disc engine as thus improved. Fig. 2 is a transverse section of the same, taken also through or near the centre; and fig. 3 an under plan. A is the steam chamber or cylinder in which the disc B oscillates; *a a* the steam induction ports, of which *b b* are the valves; C is the ball, which is attached to the disc B, and works in a seat formed for it in the cones E E and in the outer glands F F. D is the diagonal shaft, to which the ball C and disc B are attached: *c c* are the metallic packings of the kind described in the specification of G. D. Bishopp. G G are two inner glands (not used before), which we introduce for the purpose of better preventing the escape of steam from the cylinder between the ball and the cones. These glands (a front view of one of which is given separately in fig. 4) fit into recesses *e e* made for them in the cones E E, and are provided with rings or washers underneath, composed of compressed hemp or other suitable yielding material. The outer glands F F fit into the glands G G; and *g g* are set screws, which are passed loosely through the glands F F, and tap into the cones E E, so that by turning down these set screws, the inner glands G G may be as tightly compressed as need be against the packing of the ball C all round. Or, instead of the preceding arrangement, the set screws *g g* may be made to screw into and through the outer glands F F, and their points to press upon the inner glands G G. The better also to secure the ends of the metallic packing slips *c c*, we fit to the cones a ring of metal H (a plan and section of which are given separately in fig. 5); on the outside of this ring there is a series of notches or recesses *h h*, and on the top edge thereof another like series of notches or recesses *i i*, which last form (when the ring is in its place) a continuation of the grooves in the cones in which the packing slips *c c* are inserted. Fig. 6 is partly a side view and partly a section of the ring detached from the engine, showing the notches *i i* on the top edge, and also the notches upon the outside. The tail-pieces *k k* of the slips take into the notches *h h*, while the top parts *l l* fit sideways into the notches *i i*, whereby the slips are kept securely in their places under all circumstances. To provide against the wearing away of the coned end of the diagonal shaft D, or the bearing in which it is stepped, we construct that bearing in the manner represented in figs. 7 and 8, which is a section and end view of the same on an enlarged scale, with the shaft in its place. *m* is a metal tube, threaded on the outside at both ends, which is fitted loosely into the ball I of the driving crank J (fig. 1;) *n n*[1] are two nuts, which are screwed on to the two ends of the tube *m*, one of them, *n*[1], serving at the same time as a reservoir for oil or other lubricating material; *o* is a lining to the tube *m*, which is composed of tin or some other soft metal run in while in a fluid state upon a mould of the same shape as the coned end of the diagonal shaft D; and *p p* are recesses made on the inside of the tube *m*, into which part of the soft metal flows, forming projecting tie-pieces, by which the lining (after the mould is withdrawn) is kept in its place. Should the conical end of the diagonal shaft become slack in its bearing, it can be screwed close up by the nuts *n n*[1] and when the lining itself wears away in any part, it can be renewed with the greatest ease and dispatch.

Secondly. Our invention consists of a new method of applying metallic packings to the disc and cones of disc engines, which may be substituted for those last referred to as invented by G. D. Bishopp (and either in combination with or apart from our improved bearing for the conical end of the diagonal shaft.)

Fig. 9 is an edge view, and fig. 10 a front view or plan of so much of a disc engine as is necessary to show this part of our invention. B is the disc; C the ball; and D the diagonal shaft, as before. K K are a series of springs (of brass, steel, or other suitable metal), which are attached to each side of the disc, and radiate at equal distances from the circumference

of the ball to the edge of the disc. ach spring is riveted to the disc by one side only (as shown in the figures), so as to have a slight inclination outwards on the other side. As the disc rolls over the cones, the springs press against the cones with just sufficient force to keep the joining steam tight. The springs may be attached to the cones instead of the disc; but we prefer the arrangement which we have figured and described.

Fig. 5.

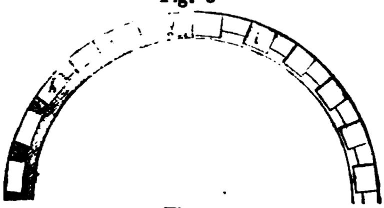


Fig. 11.

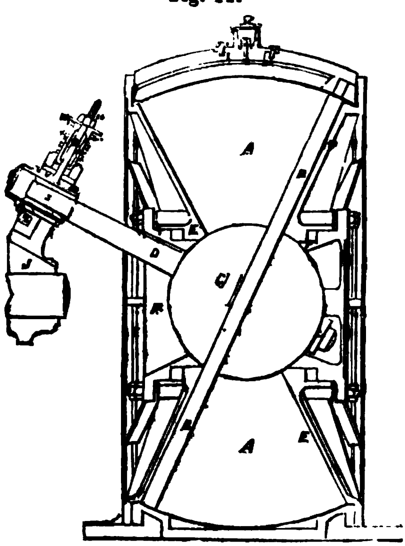


Fig. 6.

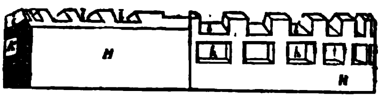


Fig. 7.

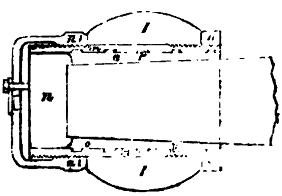
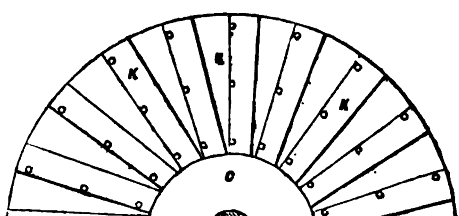
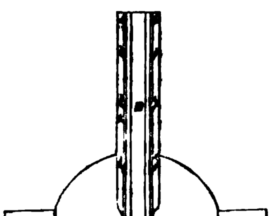


Fig. 10.





Thirdly. Our invention has reference also to the disc engine, but is applicable to that engine only when used without metallic packings, and is intended to obviate altogether the necessity of packings of any sort. Fig. 11 is a longitudinal section through the centre of a disc engine constructed according to this part of our invention. A is the steam chamber or cylinder; B the disc; C the ball; D the diagonal shaft; E E the cones; F F the glands; and J the driving crank, all as before. Fig. 12 is a front elevation of the crank J detached from the rest of the engine.

The cones E E and disc B are here supposed to be perfectly plain surfaces, or only covered with leather, felt, or some other yielding substance. In order therefore that they may be pressed closely together, and any escape of steam between them be thus prevented, we adopt the following arrangement:—

The end of the diagonal shaft D rests in a block or bearing *v*, which slides in a slot *q* made in the crank J, being kept in sideways by pins *s s*, which take into grooves in *q*. From

the block v a pin t projects, which passes through the top of the crank, and is screw-threaded at its upper end for the reception of a nut u, which sets into the washer and guide w, between which and the top of the crank there is interposed a spiral spring x. The action of the spring x has a constant tendency to draw the bearing block v, and with it the end of the diagonal shaft D, towards the top of the crank; and the diagonal shaft D and disc B being fixed at right angles in relation to each other, it follows that the more the end of the shaft is drawn towards the top of the crank, the closer the disc must be brought to the cones. Should there be any unevenness on the faces of the cones, or should they not be in perfect agreement with one another, the spring will by its own action produce the degree of adjustment or correction required. The springs can be adapted in point of strength to any degree of pressure by screwing or unscrewing the nut u on the pin t.

(To be concluded in our next.)

NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Continued from page 89.)

Third and Concluding Series.

IV. CUBIC EQUATIONS.

In the cubic

$$x^3+ax^2+bx+c=0$$

substitute $y+z$ for x, then I have shown (*Camb. Math. Jour.*, vol. ii., pp. 248-9,) that, if z be determined from the quadratic,

$$(a^2-3b)z^2+(ab-9c)z+(b^2-3ac)=0, \dots\dots\dots (1)$$

the resulting equation in y will be of the solvible form

$$\frac{1}{3\mathrm{AB}}\left\{(\mathrm{A}y+\mathrm{B})^3+(3\mathrm{AB}-\mathrm{A}^3)y^3\right\}=0 \dots\dots\dots (2).$$

From (1) we may obtain the relation (see *Camb. Math. Jour.*, vol. iii., p. 28),

$$2(a^2-3b)z=-(ab-9c)\pm\sqrt{81c^2+12b^3+12a^3c-3a^2b^2-54abc} \dots\dots (3).$$

Divide by 3 the quantity under the radical sign, and we obtain a criterion of the nature of the roots of a cubic which coincides with that given by Mr. JAMES LOCKHART, of Fasnacloich, at p. 223 of vol. iii. of the *Mathematician*.

At line 3 of page 10 of Mr. LOCKHART's recent work on the "Nature of the Roots of Numerical Equations," there occurs an example of a cubic to which I attempted to apply the same rule which I had successfully employed in treating other of his examples (*vide supra* pp. 37 *et seq.*). Its extreme difficulty, however, and the numerous figures necessary to be employed, together with the necessity I was at the time under of leaving town, prevented me from fully considering it. I wrote to Mr. LOCKHART, inclosing my operations with the Rule, which were not however complete, and did not, if I recollect a right, involve all the decimal figures included in the last term of the Example in question. I had the satisfaction of receiving a reply from Mr. LOCKHART, dated July 16, 1850, in which he informs me that the example in question took him a long time to frame, and that others have examined it and asked him for the result. That result he kindly transmitted to me worked out, and I have now the honour of laying it before the readers of the *Mechanics' Magazine*. The Note at the end of Mr. LOCKHART's calculations refer to my queries *supra* p. 38, col. 1.

Extract from a Letter from James Lockhart, Esq., to Mr. Cockle, dated 16*th July*, 1850.

$$\text{“ } x^3-\overset{a}{10}x^2+\overset{b}{10}x-\overset{c}{2\cdot64163101}=0$$

$$\begin{array}{rlrl}
a^2b^2= & 10000 & 4ca^3= & 10566\cdot52404 \\
18abc= & 4754\cdot935818 & 4b^3= & 4000\cdot00000 \\
 & \overline{} & 27c^2= & 188\cdot4117886108277427 \\
 & 14754\cdot935818 & & \overline{} \\
 & & & 14754\cdot9358286108277427
\end{array}$$

the right-hand member being greater than the left, the two roots are imaginary.

If c had been equal to $2\cdot6416310$, [the] two roots would have been real.

$$2\cdot64163101^2=6\cdot9782143929936201.$$

Note.—The equation $8c = -b$ was entirely casual; is not the 666 in your paper equally so?"

The reader will concur with me in thanking Mr. Lockhart for his discussion of this Example. J. Cockle.

2, Pump-court, Temple, August 12, 1850.

ON THE FLAT KNOT. BY PROFESSOR DAVIES.

Many of the most ordinary phenomena in physics and in mechanics not only remain unexplained, but even uninquired into. Take, for instance, the motions of the *boomarang* of the aborigines of New South Wales; take the flight of a kite in the air, or the vibratory revolutions of a spinning top on the floor; take, indeed, any of a hundred things equally simple in appearance, and we shall find that not one of them has been completely solved, even where the genius of a Euler has been taxed for the purpose.

Analagous to these are sundry arithmetical and geometrical puzzles. We may "know the solution,"—that is, the process; but we seldom trouble ourselves to search out the reasons. We know that the process *does* (in the cases we try as a matter of experiment) perform what it professes to do; but we rarely inquire whether it *must* inevitably do it in all possible varieties of case. We thus place them in the condition of all arithmetic and all geometry, *before arithmetic and geometry became sciences*. They are treated as ingenious trifling, and there left to the wondering gaze of the "uninitiated."

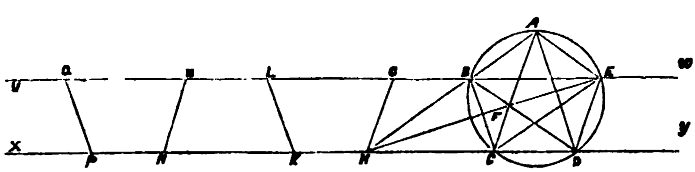
There are few mathematicians, I should suppose, who have not, at one time or other, been induced to look somewhat closely into such of these "conundrums" as happened to come before them. If the general experience in such cases has at all resembled my own, there will have been found difficulties little anticipated, and often insuperable in their complete discussion. In fact, it would be easy to fix upon a dozen such that would be far more trying than the most difficult senate-house paper ever set: for in most cases, the *general principles* of the investigation have to be wholly discovered.

Though the "flat knot" is far from being the most difficult thing of this kind that I have attempted, at one time or other to investigate, it is yet esteemed to be far from easy. It was proposed in an examination in Trinity College, Cambridge, in 1833, by Dr. Whewell, then Fellow, and now Master of Trinity. As no complete solution has, I think, been published, I beg to submit the following, which was undertaken as an amusement under tedious and painful indisposition.

"A watch-ribbon is folded up into a flat knot of five edges; show that the sides of the knot form an equilateral pentagon."—*Potts's Euc.* 8vo. ed., p. 341.

For the term "equilateral," substitute "regular" in Dr. Whewell's enunciation; for the pentagon is equi-angular also.

Fig. 1.



Analysis.—Suppose it true, and that ABCDE is the regular pentagon, constructed as in *Euclid* iv. 11, and circumscribed by the circle. If this knot be opened out, it will be by turning the plane of the paper round the several edges of the pentagon, so as to successively reverse the faces of the paper; and the parts of it which are successively opened out will be

ABCE	by revolving about	BC, in its own position.
ACDE	....	AE, in its new position.
CDBA	....	CD ....
ABDE	....	AB ....
BDEA	....	DE ....

Now it is readily deducible, from what is done and proved in iv. 11, and from elementary properties of the circumscribing circle, and the lines here drawn in it, that:—

(*a*) All the five diagonals, AC, CE, EB, BD, DA are equal:—

(*b*) Each of them is parallel to its non-contiguous side; as CE to AB, &c.

(*c*) Each of the triangles, as BCE, formed by the pairs of diagonals that meet in one angular point C of the pentagon, and having the opposite side of the pentagon for its base, is in all respects equal to the constructive triangle CAD; each part in one to its corresponding part in the other triangle.

(*d*) In five trapezoids ABCE, ACDE, CDBA, ABDE, and BDEA, are in like manner wholly equal part for part.

(*e*) The angles of the pentagon, as ABC, are each divided into three equal parts by the diagonals BE, BD, drawn to the angular point; each of these parts is equal to the vertical angle of the constructive triangle CAD; and any two of them together are equal to either of the equal angles ACD or ADC at the base of the constructive triangle.

Produce CD, BE; draw EF perpendicular to BC; produce it to meet CD in H; join HB; and draw HG parallel to AC, meeting EB in H.

Since CD is produced, we have

ACH = ADC + CAD = ACD + ACB = BCD; or HCB = BCE. Also the angles EFC, HFC, are equal, being right angles by construction; and the side CF common: wherefore the other sides are equal each to each, viz. HC = CE, HF = FE (i. 26.)

But since BEC is an isosceles triangle, the perpendicular EH bisects the base in F, and BE is parallel to GH, it is easily deduced that the four triangles which have the common point F are in all respects equal to one another; and hence that the triangle HCB is in all respects equal to ECB. That is, HB = BE, and the angle BHC = BEC.

Now, a line FE perpendicular to BC in any one position of the plane which revolves about BC will be perpendicular to it in all positions; and hence, when it is brought into continuity with its original position, or so that its faces are reversed. Whence, after the partial expansion of the knot by turning about BC, the line FE will be in the position FH; and because FH = FE, the point F will coincide with H, and the triangle BEC with BHC. The side CE therefore coinciding with CH, and CH being the prolongation of CD, the condition of linearity is fulfilled as regards one diagonal CE of the expanded knot, and its adjacent side CD.

Again; because AB is parallel to CE, and BE to CD, we have the angles

ABE = ECD = CEB = CHB;

and hence ABH is one straight line; and hence the angle GBH = ABE. And since GH is parallel to AC by construction, we have GHB = BAC = BEA. The triangles GBH, ABE are hence in all respects equal (i. 26;) and as when the plane ABCE is turned over, BE coincides with BH; and therefore the triangle ABE with GBH, each part with each part respectively.

The continuity of the diagonal BE, and its adjacent edge AB, in the partially expanded knot is hence conclusive; and the trapezoid ABCE takes a continuous position with respect to the trapezoid BCDE: their longer and shorter parallel sides being simply reversed in position upon the edges of the ribbon.

If the remaining part of the unfolded knot be supposed to accompany the opened part ABCE in its revolution about BC, then the trapezoid ABCE will be capable of revolution about AE in its new position HG. By similar reasoning it may then be shown to unfold into the position GHKL, having the longer of the parallel sides EC continuous of GB, and the shorter continuous CH; and so on till all the trapezoidal segments of the ribbon be opened out.

We have now arrived at this conclusion, that if trapezoids of ribbon all equal to each other, and each equal to the figure formed by three contiguous sides and the diagonal of a regular pentagon, be rendered coherent at their junctions BC, AE, CD, AB, DE; and then opened out as above described, they will form one continuous ribbon.

Scholium on the Analysis.

Viewed as a theorem, this analysis is complete; and if proposed as a problem, to tie a flat pentagonal knot, it is so far complete that the construction is readily suggested from this analysis. We see

how to trace the folds upon the ribbon, or rather know the forms of its trapezoids when so divided. It may, however, be worth while to give that construction.

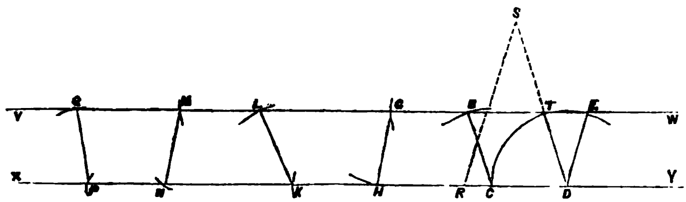
The immediate object, however, of this scholium, is to enforce a doctrine respecting the analysis of theorems that I have elsewhere enunciated. It is, that *the analysis of a theorem is the demonstration of one or other of its converses.* Thus, instead of proving that a ribbon folded up pentagonally, folds into a regular pentagon, the truth of this is assumed, and it is proved that the pentagonal tie is expansible by unfolding into a series of trapezoids which take positions coincident with the continuous edges of the ribbon. The direct proposition, that is the one proposed to be proved, takes the form—that if a ribbon have a series of creases made in it, so that the trapezoids shall have a specific form, the ribbon doubled over at these creases will form a flat knot, the edges of the ribbon forming the sides and diagonals of a regular pentagon.

In my view, a clear perception of this relation between the analysis and synthesis of a *theorem* is of great importance towards a right understanding of geometrical analysis generally.

SYNTHESIS.—We shall first trace the creases of the ribbon, so that it shall fold about them into a regular pentagon; and then prove that no other creasing would allow the ribbon to be folded into any pentagon whatever, without crumpling or tearing.

(1.) *To crease the ribbon.*

Fig. 2.



Let VW, XY, be the parallel edges of the ribbon; and D be chosen as the starting point of the folding. Take any distance DR on XY, and construct the triangles RSD to fulfil the conditions of iv. 10; and let DS meet VW in T. Make in succession DW, DC, CB, BG, GH, HK, KL, ..., PQ, each equal to DT; and the cross-lines DE, CB, ... MN, PQ, will be the creases of the ribbon.

To prove this we have only to establish that BCDE is a trapezoid similar to that in fig. 1, or in the fig. to *Euc.* iv. 11; and that all the other trapezoids so constructed are similar and equal to this, and disposed with respect to each other as in the expanded ribbon in the analysis:—both of which are such very simple geometrical processes as to render unnecessary any further details here.

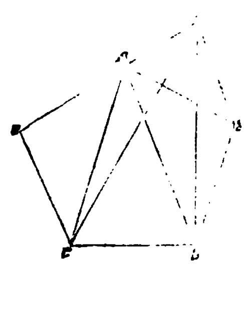
Moreover, by a simple reversal of the terms of each step of the analysis (or the process of the unfolding) it may be shown that when these trapezoids are doubled up in succession, they will take positions identical with the corresponding ones of the regular pentagon.

Whence it follows, that a ribbon *can be folded* so as to form a regular pentagon, and the positions of its creases have been predetermined.

(2.) *The ribbon cannot be folded into any other pentagon,* without rupture or duplication.

For let us admit the least possible divergence from the regular pentagon: that is, take the most favourable case to the denial of the truth of our proposition.

Fig. 3.



Thus, let ABCDE be the regular pentagon into which the ribbon can be folded, as already shown; and, if possible, let the ribbon be capable of folding into the pentagon A′BCDE, where A′ is in AB produced; and draw A′C, A′D, A′E.

Then since A′C, DE are portions of the opposite edges of the ribbon, A′C is parallel to DE. Also AC is parallel to DE by the former reasoning; and hence A′C, AC are parallel, or coincident. They are not coincident, since A′ is a different point from A and without the line AC.

The same kind of reasoning applies to A′E being parallel to AE, and A′D to AD.

Whence in this case the ribbon must be narrowed in one part and widened in another, (so that the knot shall be formed at all,) contrary to the conditions from which we set out. In other words, the ribbon must have *serrated* instead of *straight* edges.

In the same way any other special hypothesis respecting the divergency of the knot from a regular pentagon, will lead to discrepancies of result of the same general kind.

It may to some minds be more satisfactory, as geometrically it would be more elegant and systematic, to make no hypothesis whatever as to the nature of the irregularity of the supposed pentagon. Nor is the proof difficult in this form, though its details are somewhat long. The conditions of such a mode of establishing it will hence be merely indicated here; viz., to show that in an irregular pentagon the following relations cannot co-exist:

(*a*.) That the diagonals cannot *all* be parallel to the opposite sides, and equidistant from them; as AC and DE, BD and AE, etc.

(*b*.) That the acute angle of the trapezium BCD is the supplement of the angle of the pentagon BCD; and so likewise with each of the other four cases simultaneously with them.

Scholium.—Perhaps there are few figures that possess a more interesting series of properties than the regular pentagon; and for the most part these are almost isolated from the properties of all other regular polygons, except those whose sides are numerical multiples of five. There is, indeed, one property which connects it with the hexagon and decagon conjointly, and likewise one which connects it with the decagon and the constructive triangle. These are given by *Euclid*, xiii., 10 and 9 respectively. Some others are strewed about in different places; but there are many yet discoverable—as not a small number have presented themselves to my mind, when engaged in inquiries directed to special purposes, but collateral only to a general investigation of the properties of the pentagon in their natural relation to one another. Some of these appear to be cardinal properties; that is, such as form the nuclei of separate classes of properties. May I here recommend them to the attention of younger geometers? I, at least, have little reason to anticipate the command of the time necessary for pursuing the inquiry.

The division of the line itself (the side of the constructive triangle in iv. 10), has attracted much attention. It is given as a problem in ii. 11; it is again given as vi. 30: and at the opening of the Sixth Book it is designated also by a *name*. This name is rather a phrase than a mere compound term, and highly elliptical in its form; and there is reason to think that even this has been corrupted in its turn, and after the strict signification of it had been lost—as no one has yet been able to supply the omitted words, so as at the same time to "make sense and grammar," either in Greek or English. The phrase "extreme and mean ratio" is simply an absurdity, if Euclid's previous definitions (the 5th Book) be retained.

Many names have been proposed for this division of a line. Lucas de Burgo was so enamoured of it that he wrote a folio volume to illustrate that everything beautiful in art or nature (the human figure included) was fashioned after this division of a line. In his eyes it formed the Creator's working rule; and he called it accordingly the "Divine Section." The most eligible term is, perhaps, that of Sir John Leslie—"Medial Section;" and I think it likely that this will be the ultimately prevailing one. It is brief, sufficiently expressive, and has not been appropriated to any other purpose, from which confusion could ensue.

The property of this division, its reproduction by augmentation and diminu-

tion *ad infinitum*, is the best known—and was known to de Burgo. It is, however, but one of a most interesting series of properties, very few of which appear to have been noticed by geometers—though they would amply repay the trouble spent upon their investigation.

Lest, however, I should be supposed to be manufacturing a new version of "Much-Ado about Nothing," I will desist from further remark.

T. S. D.

Shooter's Hill, August 2, 1850.

MORE WORK FOR ENGINEERS!

Blackfriars-bridge continues to follow the footsteps of its elder brother of Westminster, by sinking deeper and deeper every day. One of the piers is reported to have subsided from 10 to 12 inches, and well it may, for the current is running through the foundation like a sieve. The authorities are greatly alarmed, and no wonder, for most of the arch stones over the crown haunches of the centre arch have cracked right through. The diving-bell has been at work all the week, and the divers report that the water has washed away the bed of the river below the bottom of the piles. As a remedy, they are throwing barge-loads of Kentish rag stone into the river for the purpose of preventing the wash, which, now that Old London-bridge has been removed, has been greatly increased. The fact is that the bed of the river is adjusting or lowering itself to the increased inclination given to it, and has sunk so low that the stepping courses of Waterloo and Southwark-bridges, which were formerly covered, are now visible at low water; which is also the case with the mouths or outlets of all the sewers which empty themselves into the river. Fortunately for the more recent bridges of Vauxhall, Waterloo, Southwark, and London, the change has been anticipated by carrying their foundations down to the clay, or they would have shared a similar fate to Westminster and Blackfriars. Report says also, that it is contemplated to use iron piles for the foundations of the new bridge of Westminster, driven by atmospheric pressure, on the late Dr. Potts's principle. If so, we shall have such another mess as happened with the foundation of Windsor-bridge, which gave way from being built on a foundation of piles driven on Dr. Potts's plan. The fates of Westminster and Blackfriars ought to serve as a warning against experimental engineering.

PONS ASINORUM.

MR. PAXTON'S DESCRIPTION OF HIS DESIGN FOR THE BUILDING FOR THE EXHIBITION OF 1851.

On the 6th inst., a meeting was held in the Town-hall, Bakewell, in support of the proposed National Exhibition for 1851. The Earl of Burlington presided, and having opened the proceedings, was followed by

MR. PAXTON, who said, that until there was a squabble in the newspapers about the site and plans for the proposed Exhibition, he had never turned his attention to it. It was not for him to speak of the merits of his design; he would leave the unanimous selection of the six well qualified gentlemen who acted as the Committee to speak for itself. (Hear, hear.) He would confine himself to a few particulars regarding the dimensions and construction. The building would be 2,100 feet long by 400 broad. The centre aisle would be 120 feet broad, or 10 feet wider than the Conservatory at Chatsworth. When he commenced designing this building he knew that so vast a structure as this must necessarily be made as simple as possible in its details, else it would be impossible to carry it out; he therefore endeavoured to make it up with as few details as possible. The glass and its iron supports comprised the whole structure. The columns were precisely the same throughout the building, and would fit every part; the same might be said of each of the bars; and every piece of glass would be of the same size—namely, four feet long. No numbering or marking would be required, and the whole would be put together like a perfect piece of machinery. Mr. Paxton explained that the water is brought down valleys on the roof, and thence down the columns; that the water in no instance has further than 12 feet to run before it is delivered into the valleys or gutters; and that the whole is so constructed as to carry the water outside, and the condensed water inside. The building is divided into broad and narrow compartments, and by tieing these together there is little for the cross-ties of the centre to carry. The building is entirely divided into 24 places—in short, everything runs to 24, so that the work is made to square and fit, without any

small detail being left to carry out. The number of columns, 15 feet long, is 6,024; there are 3,000 gallery bearers; 1,245 wrought iron girders; 45 miles of sash bars; and 1,073,760 feet of glass to cover the whole. The site will stand upon upwards of 20 acres of ground, but, by an arrangement of Mr. Paxton's, the available space which may be afforded by galleries can be extended to about 30 acres if necessary. In so far as merit was concerned, in his (Mr. Paxton's) opinion, the plan occupied a secondary position in comparison with the execution of it, and which would speak volumes in favour of the ingenuity, perseverance, and industry of Englishmen. The plan, as he had shown them, was simple enough; but their surprise, if they could form any calculation of the gigantic size of the structure, would be great indeed, when he told them that the whole would be covered in by the 1st of January next, and he was as firmly persuaded that it would be accomplished to the day as he was sure that he was addressing that meeting. That fact alone would show the skill and industry of Englishmen. He proceeded to state that the gallery of the building would be 24 feet wide, and would extend a distance of nearly six miles. Now if, after the purposes of the Exhibition are answered, it was thought desirable to let the building remain—and he sincerely hoped it would not be pulled down nor shipped to America—if they chose to let it remain, see to what a purpose it might be applied. There might be made an excellent carriage drive round the interior, as well as a road for equestrians, with the centre tastefully laid out and planted, and then there would be nearly six miles of room in the galleries for a promenade for the public. With regard to the ventilation and the rays of light, he would say that the former was a very peculiar part of the plan. The whole building, four feet round the bottom, will be filled with louvre or "luffer" boards, so placed as to admit air, but exclude rain. On the inside of that there will be a canvass to move up and down, and in very hot weather it may be watered, and the interior kept cool. The top part of the centre building is put up almost entirely for the purposes of ventilation; and he thought it would be found that if he had erred at all in respect of the means of ventilation, there would be found too much rather than too little. By covering the greater part of the building with canvass, a gentle light would be thrown over the whole building; and the whole of the glass at the top of the northern side of the building would give a direct light to the interior. If more light was wanted, the means of affording it were provided. It was, in short, impossible to devise a plan better calculated for the purposes of light and ventilation. Since the contract had been taken by Messrs. Fox and Henderson, he had suggested to them a plan by which they might effect some saving of expense, and also promote their convenience. He recommended them to erect scaffold poles by the sides of the columns to support the canvass, and thus the workmen would be enabled to construct the building under its shelter.—*Daily News.*

FALL OF A FACTORY AT STOCKPORT, 30 JULY, 1850.

[On the 30th July last, a large portion of a new factory, erected near Stockport for Mr. Cephas Howard, fell to the ground, and caused the death of thirteen persons. An Inquest was subsequently held on the bodies of the deceased, when the jury found that they "had come to their deaths accidentally through the partial falling of the floors," which "were *supported by a cast iron beam of an imperfect construction, and of an improper calculation, considering the weight it had to bear.*" We extract from the proceedings at the Inquest the description given of the building by Mr. Hopkinson, of the firm of Messrs. Wren, Bennett, and Co., by whom the building was designed and the iron-work furnished, and his explanation of "the calculation" which the verdict declares to have been "improper." We give also the Report made to the Jury on the subject by Mr. Wm. Fairbairn, C.E., by which, no doubt, the Jury were guided to the conclusion at which they arrived, and which will be found to contain much valuable matter, of universal interest to the engineering profession. Figs. 1, 2, 3, 4, 5, and 6 of the accompanying engravings have been made from those exhibited to the Jury by Mr. Hopkinson. Fig. 1 is a longitudinal elevation, and fig. 4 a plan of the beam which gave way and brought down with it the greater part of the five floors above; fig. 2 is a section of the beam through the centre; fig. 3 a section of it on the line of fracture; and fig. 5 a section of the broken

Fig. 1.

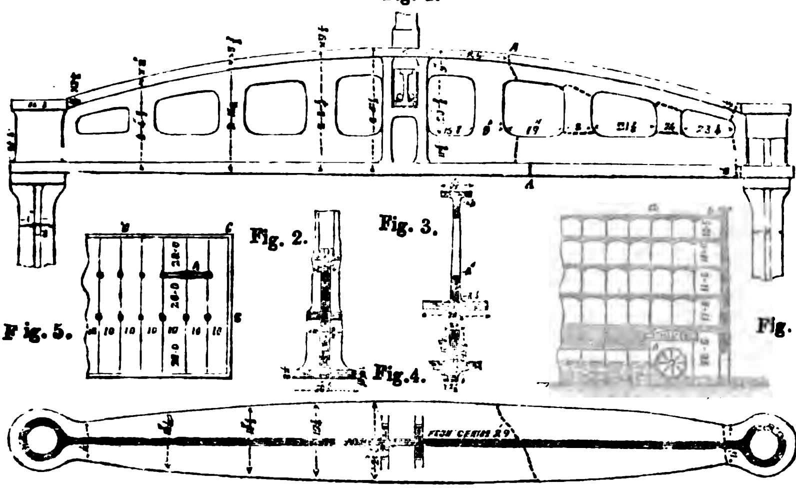


Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.

pillar. We add two sketches with which we have been favoured from another source; one (fig. 6) being a plan, and the other (fig. 7), a longitudinal section of the building. The portion of the floors which fell was all that included within the lines *c, c, c, c,* fig. 7, comprehending an area of about 1200 square feet.]

Mr. Hopkinson's Statement.

We were employed by Mr. Cephas Howard to furnish drawings for the mill, and to superintend its erection; we constructed the water-wheel, as well as the shafting and gearing; we did not contract for the erection of any part of the mill; we had specimens of the size of the mill; the mill was not built according to the original drawings, but in accordance with subsequent ones; the size of the mill was to be 140 feet long inside, supported by 14 regular 10 feet bays, the width 60 feet, in three compartments of 20 feet each. The mill was originally designed to be four storeys in height; a portion was five storeys, where there was a cellar for four bays at the west end. To superintend the erection of the works effectually, we had on the ground Mr. Daniel Glover, as clerk of the works; I had great confidence in him from previous knowledge, and from his conduct in this matter. In case anything was wrong, the ultimate appeal was left to Wren and Bennett. This mill was intended to be turned in part by a water-wheel; there was a tunnel under the mill, 19 feet wide and 22 feet high; it was under the whole length of the mill, and from the first it was intended that the water-wheel should be fixed in this tunnel; the fixing of the water-wheel in this place would not, according to the original drawings, have interfered with the pillars. The fixing of the wheel rendered it necessary to dispense with one of the pillars; one entire range of pillars goes right through the old arch or tunnel down to the rock below; first of all they were wedged in the arch, and then connected by tie-bars with each other, and the adjoining walls; those pillars were cruciform in section; where the water-wheel was intended to be one pillar could not be put, because it was under it; we designed a plan to dispense with the pillar; a large cast-iron flange beam with a curved top was substituted; it was 3 feet 4½ inches deep in the middle; the bottom flange was 20½ inches wide, and of an average of 3½ inches thick; the length of the beam was 20 feet from

centre and centre; the depth of the beam at the end was 20¾ inches; the top flange was 9½ inches broad, by 2 inches thick in the middle; the dimensions in the drawing of the beam produced are correct—(see figs. 1, 2, 3, 4,)—the ends of the large beam were circular, forming a gland; the beam was completely circular, went over the pillars, and went over collars on each column prepared to receive it; the diameter of the circle is 9½ inches inside; we designed two columns to support this beam; they were cruciform in section, like the other long ones; they were 23 feet long to the underside of the beam; they were much longer than the other columns, as they had much more to carry, being 16¼ inches across the middle one way, and 18½ across the middle the other way, and 2¼ inches thick in metal; they were 11 inches across the transverse bars; the collar which supported the beam was 18 inches in diameter; one entire line of column, four storeys in height, rested upon the centre of the large beam, which also carried in boxes prepared to receive them the ends of the two of the ordinary fire-proof beams, forming part of the ground-floor, or the floor immediately over the cellar; these were bolted to each other through the large transverse beam, extended to walls on each side, and were intended to prevent the beam giving way sideways, as well as to support the floor; we consider that lateral stay was of great importance in maintaining the stability of the structure; we determined the form and weight of the beam upon calculations based upon experience; we should have avoided, if practicable, placing the entire weight of a row of columns on the middle of the beam; we consider that altogether the machinery, arches, and pillars, resting on the beam, would be equal to 62 tons; that is the load we believe was constantly on the middle of the beam; we also considered it might some day also be loaded with people, and that was the most considerable strain that could by possibility come upon it; that might increase the weight upon the centre for a time to 81 tons, supposing the two storeys of the four were loaded with people standing as closely as they could be packed. From calculations based upon experience, I come to the conclusion that the beam would break when a weight was upon it of 280 tons; I cannot give any idea as to the breaking weight of the two pillars, which supported the beam. They were fit to bear the greatest weight I ever calculated could come upon them. The cruciform form of pillars was adopted after mature deliberation, and for important practical reasons; it was not that we considered this form the strongest, or that it permitted the most economical distribution of the metal; I believe this is still the subject of debate amongst scientific men; our decision in favour of the cruciform shape was influenced by a consideration that in castings of such extreme length, had they been circular columns of the same weight as these, there would have been the greatest danger and risk of having the metal unsound, or irregular in thickness on the sides, and at the same time there would have been no opportunity of practically testing whether they were really sound or not; but in the cruciform shape we could eye it all round. I produce a section (fig. 5) of one of the pillars which is broken; the diameter outside is 7½ inches; one side is 2¼ inches in thickness, and the other seven-eighths of an inch; the pillar I refer to was one of the pillars in the bottom storey; it must have been one of the three pillars of the bottom storey; this pillar is broken in two; the fracture is slightly an oblique one; this defect could not be perceived outside the pillar; the cruciform shape of pillar allowed more room for the introduction of the water-wheel, and it afforded us considerable convenience in attaching the breast or sluices of the water-wheel; I believe this form of pillar has been used by architects of the greatest eminence; I believe they have been adopted in the new Houses of Parliament by Mr. Barry; the interior of the Manchester Athenæum rests upon four columns of the same description, and all the pillars in the Free Trade Hall are of the same description; we wished to obtain as much depth as possible in the middle for the beam over the water-wheel; the models for the beam and pillars were inspected by us before they were cast: the castings were made according to the models, as far as I know; Messrs. Williamson and Roberts, of Heaton Norris, furnished all the castings, under contract with Mr. Howard; we were not parties to that contract, but I believe it was stipulated that the work should be done to our satisfaction; I inspected the models before the beam and pillars were cast; Glover would inspect the castings; we tested some of the ordinary beams; we broke one down at 28½ tons dead weight, slung upon the middle; that would be about four times the load it would have to bear; the large beam was not tested; the reason was that we had no means of slinging so heavy a weight as its own load; I believe means have been used in London, by hydraulic power, to test such beams, but it is not usual in this neighbourhood; the large pillars were not tested; I saw the large beam on the ground before it was put up; it was the duty of the clerk of the works to see that

all the castings were sound; after the large pillars were up, I inspected them minutely; I found them perfect to outward appearance; the large beams were put in in the beginning of September, I should fancy; I do not know when the erection of the arches and the flooring was commenced; the roof arches were turned in December, and that work was rapidly proceeded with; the arches of all the floors would be completed within three months, and the centres cleared away; I am not aware that any observation was made when the weight came upon the large beam as to whether it deflected or not; we looked along the beam and saw it looked straight; I saw it looked straight after the arching was complete; I went myself to the end and cast my eye along it; we considered there was so large a margin of strength that there was no doubt about its stability; at the time I looked along the beam it was not weighted with machinery. The foundation of the two pillars supported the beam in solid rock; there was no masonry, but the pillars were imbedded in an iron plate 3 feet square; the mill-gearing would not add to the weight on the beam, but the vibration of the mill might have an injurious effect upon the beam or any other part of the building; I do not think it had, but it might have; I considered the beam was so stayed and supported that vibration could have no effect upon it; after the first drawings, the site of the mill was changed; had the original design been carried out there would have been no need of a large beam. The site of the mill was shifted 11 feet nearer to the river; that caused the alteration in reference to the beam; the proprietors considered the alteration in reference to the site of the mill an improvement.

* * * *

There must have been a most tremendous strain upon the mill when the accident happened; the general stability of the mill was beyond all question; the common pillars were not tested beyond an external examination. The drawings produced show the fractures of the large beam; the beam is now nearly in the same position in which it was found. One of the pillars which supported the beam is broken off at the top and pushed aside; the other remains entire.

Mr. Fairbairn's Report.

Cast iron may be said to be of almost universal application at the present time in the construction of buildings. Its use is at all events very extended, and the repeated occurrence of lamentable accidents, which have hurried numbers to their graves without the means of escape, or a single moment's reflection, evidences a deplorable want of knowledge of its general properties amongst those who undertake the designing and erection of buildings, and seems to call for the interference of the strong arm of the law, or, at least, for the supervision of some higher authority than now exists to enforce obedience to those well-established principles and facts which point out a way to its perfectly secure adaptation when duly and accurately proportioned to the duties it may be called upon to perform. No material is of greater value in all the requirements of building, machinery, and the constructive arts generally; and when employed under the direction of men of knowledge and judgment, it fully establishes its claim to be reckoned amongst the most valuable mineral productions of the country. On the other hand, when its application is undertaken by, or entrusted to the management of, the unthinking and ill-informed, who possess no knowledge of, or have not taken the trouble to make themselves acquainted with its cohesive strength and powers of resistance, it becomes in such hands a most dangerous enemy, instead of a useful and powerful auxiliary.

The following qualifications appears to me necessary to the successful pursuit of his profession by the practical architect and engineer: first, a knowledge of the strength and other properties of the materials which he employs; secondly, the skill necessary to distribute and proportion the parts in such form as will insure the maximum of strength with the minimum of material; and lastly, in the use of cast iron and other metals, an acquaintance with the laws of expansion and contraction, in order that he might be enabled—in every construction which requires strength, and in the security of which the safety of the public is involved—to reckon with certainty upon the calculated or estimated duty of each particular casting.

With these preliminary observations, and the more fully to ascertain the cause of the late accident, I would beg to direct the attention of the Jury to the scene of its occurrence, and to the state in which the building may be supposed to have existed previous to the fall. It will be observed that a water-wheel, about 20 feet wide and 18 feet 6 inches diameter, was placed under the floor at the lower end of the mill, and that in order to carry those portions of the floors immediately above it, two columns in the form of a cross, A A, and the large beam B, were introduced as a substitute for the usual means of support, which, but for the water-wheel, would have gone down and rested upon the solid rock, the same as the

other parts of the building. This could not, however, be accomplished; and we must now see what were the means adopted to meet the difficulty, and afterwards inquire what should have been the means necessary to give stability and security to the structure under the circumstances. Had the regular system of support followed in other parts of the mill been applicable in this particular spot, and had not the introduction of the large beam B been necessitated by the position of the water-wheel, the structure would, in all probability, have been standing in perfect security at the present moment. From this it follows that, according to my judgment, it must be admitted that the accident is attributed solely and entirely to the failing of this beam. The water-wheel was immediately under the column which rested upon the cross beam. This beam was again supported by the columns, AA, 23 feet long (in the plan produced), each running down, one in front and the other behind the water-wheel, to the bottom of the tail race. It may be questionable, in some minds, whether these columns, of such great length, were sufficiently strong; but on this point I have no doubts, although it must be admitted that they are not the strongest form of section, and that they would have been doubly secure if the same amount of material had been thrown into the form of cylinders. The columns I, however, consider were sufficiently strong for the weight they had to support, and the causes of the failure cannot therefore be connected with them. With regard to the strength of this large beam, I, however, entertain a totally different opinion; and a comparison of the load it had to sustain with its powers of resistance will, I think, show that it must have been in a very precarious position from the commencement of the arching of the different floors till the very moment of rupture. To ascertain the exact ultimate powers of resistance of a beam of the form and construction adopted in the present case, it is a question of considerable difficulty, owing to the large proportion of the body of the beam which had been cut out. I have always entertained a strong dislike to beams or girders having the two resisting sides of tension and compression separated by openings of any kind, either in the shape of lattice work, or any form of opening which has the tendency to injure these two important forces. I am a strong advocate for a solid connection of the upper and lower flanges of a beam, of whatever form it is made, or of whatever material, and think that a comparison cannot be admitted between what the solid beam would have carried (supposing the castings to be equally sound in either case), and the weight with which the open beam actually broke. On a careful comparison of these weights, I find that the beam, if it had been solid, would have required a load of 280 tons in the middle to insure fracture, whereas it gave way with the weight of the beams and arches, one row of columns and machinery, not exceeding 80tons. The ratio, therefore, between the beam, if solid, and the beam open, is in this particular instance as the numbers 280 to 80, or 1 to 3½, the solid beam being more than treble the strength. Now it appears to me that so extraordinary a disparity as this cannot under any circumstances be reconcilable with the simple introduction of openings in the conducting or middle web of the beam, and I have, therefore, been induced to direct my attention to an endeavour to discover some additional cause of weakness, which would satisfactorily account for the remarkable falling off in the bearing powers of the beam. After a careful consideration and examination of the subject, it is my opinion that the same unfortunate decision which introduced the obvious defect observable in the construction of the girder with this open web, at the same time brought into operation another, and, perhaps, even more formidable element of destruction, in the opportunities which it afforded to the effects of unequal contraction in the cooling of the casting. This dangerous agency it is, at times, impossible to detect; and on this very account it is the more imperative that every form of casting should be avoided which is at all likely to call it into action. Its effects are too disastrous to be contemplated; for, in the present unfortunate instance we find the paltry saving of half a ton of metal has reduced the strength of the beam from 280 to less than 100 tons. This is a subject of vast importance in the construction, forms, and sections of cast-iron beams, and I avail myself of this opportunity to make public the difficulties which I have myself repeatedly experienced in the casting of large beams. On the occasion of casting the beams which supported the hydraulic presses for raising the great tube at Conway, the centre breaking weight of each beam was, by calculation, upwards of 700 tons; and as each of these beams were absolutely required to sustain a load of 375 tons, equally distributed, it became necessary to use every precaution, not only as respects the strength, but also as regards the quality of the castings, and the adoption of such a form as would ensure uniformity in the rate of shrinkage which accompanies the process of cooling. To give increased support to the upper or lower flanges of the beam, it was suggested to introduce vertical ribs of the same thickness as the body of

the beam, at distances of three feet along the surface on each side. The result of this alteration was, to use a familiar expression, the beam became "hide-bound;" unequal shrinkage took place, and out of four successive castings every one of them cracked along the edge of the vertical ribs. These experiments, and others which have been made since, convince me that, in every cast-iron beam, the top and bottom flanges, as well as the body, should be removed as much as possible from everything in the shape of ribs, and to arrive at the practical section of greatest strength, it should be cast solid with smooth surface on all sides. In the large beam now under consideration, it appears that in addition to the opening, along the middle, two strong vertical ribs with a shelf to receive the two arch beams were introduced. Now, both of these have contributed to induce unequal contraction, and by that destructive process materially to injure the strength of the beam. If this be the case, it would be, in my opinion, unjust to attribute the whole cause of failure to the engineer having cut out considerable portions of the metal from the centre of the beam. A combined tendency to destruction has more probably been going on, viz., one from the influence of unequal contraction, and the other from the injudicious conduct of the architect, in having by such wide openings destroyed the important connection which should always be maintained between the top and bottom flanges. I have, therefore, no hesitation in stating that I have come to the conclusion, that the unfortunate accident at the Brinksway Mill has arisen from the weakness of the large beam which supported the columns and brick arches over the water-wheel. My opinion further is, that although the bearing powers of the beam had been very materially diminished by the openings made in it, yet it appears that it is in some measure owing to the unequal shrinkage of the casting during its cooling, occasioned by these very openings, that we must attribute failure.

ON THE INCRUSTATIONS WHICH FORM IN THE BOILERS OF STEAM ENGINES.

(From a letter addressed to Dr. G. Wilson, F.R.S.E., by Dr. J. Davy. Read at the Edinburgh Meeting of the British Association.)

On entering on this inquiry, which I did after my return from the West Indies in December, 1848, and after communicating a short paper to the Royal Society "On Carbonate of Lime in Sea-water," it appeared to me desirable to collect as many specimens as possible of incrustation from the boilers of steam vessels, now so widely employed in home and distant navigation. * * * * The character and composition of the incrustation, whether formed from deposition from water of narrow seas or of the ocean, I have found very similar—with few exceptions, crystalline in structure, and, without any exception, composed chiefly of sulphate of lime; so much so, indeed, that unless chemically viewed, the other ingredients may be held to be of little moment, rarely amounting to five per cent. of the whole.

* * * *

To endeavour to prevent the deposition of the incrusting matter or to mitigate the evil, various methods, it would appear, have been had recourse to—some of a chemical kind, as the addition of muriate of ammonia and sulphate of ammonia to the water in the boiler—without success, as might be expected;—others, of a mechanical kind, with partial success—as the introduction of a certain quantity of sawdust into the boiler, or the application of tallow, or of a mixture of tallow and plumbago to its inside, to prevent close adhesion, and the more easy separation of the incrusting matter either by percussion, using a chisel-like hammer—or by contraction and unequal expansion, by means of flame kindled with oakum, after emptying the boiler and drying it. Of all the methods hitherto used, that of "blowing off,"—that is, the discharging by an inferior stop-cock a certain quantity of the concentrated water of the boiler by the pressure of steam, after the admission above of an equivalent quantity of sea water of ordinary density, appears to be, from the reports made, the most easy in practice, the least unsuccessful, and the most to be relied on. But it can be viewed only as a palliation. Considering the composition of the incrusting matter and the properties of its principal ingredient—the sulphate of lime, a compound soluble in water and in sea water, and deposited only when the water containing it is concentrated to a certain degree, there appears to be no difficulty theoretically in naming a preventive. The certain preventive would be the substitution of distilled or rain water in the boiler for sea water. Of this we have proof in the efficacy of Hall's condenser, which returns the water used as steam, condensed, after having been so used:—but, unfortunately for its practical success, the apparatus is described as being too complicated and expensive for common adoption. Further proof is afforded in the fact that the boilers of steamers navigating lakes and rivers in the waters of which there is little or no sulphate of lime, month after month in continued use, remain free from incrustation. This I am assured is the

case with the steamers that have been plying several summers successively on the lake of Windermere. And it may be inferred, that in sea-going steamers in which sea water is used in the boiler—or, indeed, any water containing sulphate of lime, the prevention of deposition may be effected with no less certainty by keeping the water at that degree of dilution at which the sulphate of lime is not separated from the water in which it is dissolved. From the few trials I have made, I may remark that sulphate of lime appears to be hardly less soluble, if at all less, in water saturated with common salt than in perfectly fresh water. This seems to be a fortunate circumstance in relation to the inquiry as to the means of prevention, and likely to simplify the problem. If these principles be sound, their application under different circumstances, with knowledge and judgment on the part of the directing engineer, will probably not be difficult. His great object will be in sea-going steamers to economise the escape of water in the form of steam, and thereby also economise heat and fuel;—also, when fresh water is available to use it as much as possible; and further, to avoid using sea water as much as possible near coasts and in parts of seas where sulphate of lime is most abundant. From the incrustation on the boilers of sea-going steamers, the attention can hardly fail to be directed to that which often forms, to their no small detriment, in the boilers of locomotive-railway engines, and of engines employed in mines, and in the multifarious works to which steam power is now applied. These incrustations will of necessity be very variable, both in quantity and quality, according to the kind of ingredients held in solution in the water used for generating the steam. Hitherto I have examined two specimens only of incrustations taken from the boilers of locomotive engines, and a single one only from the boiler of a steam engine employed on a mine —a mine in the west of Cornwall. The latter was fibrous, about half an inch thick, and consisted chiefly of sulphate of lime, with a little silica and peroxide of iron, and a trace of fluorine. The former were from one-tenth of an inch in thickness to one inch. They were laminated, of a gray colour, and had much the appearance of volcanic tufa; they consisted principally of carbonate and sulphate of lime with a little magnesia, protoxide of iron, silica, and carbonaceous matter—the last two, the silica, and carbonaceous matter, probably chiefly derived from the smoke of the engine and the dust in the air. From the engineer's report it would appear that the thinnest—the incrustation of about one-tenth of an inch—had formed in about a week, during which time the locomotive had run about 436 miles, and consumed about 10,900 gallons of water.

ECONOMICAL USE OF THE GASEOUS ESCAPE FROM BLAST FURNACES AT IRON-WORKS.

At the late meeting of the British Association, Mr. Palmer Budd made some remarks in continuation of a paper which he had contributed to the meeting at Swansea, in 1848, "On the Value of the Gaseous Escape from the Blast Furnaces at the Ystalyfera Iron-works," in Wales.

Dr. Robinson (the President), in introducing Mr. Budd to the section, said the subject on which that gentleman was about to speak was one of very great importance to the iron trade of this country. According to the present system, an ironfounder in melting a ton of iron sent out into the atmosphere about four tons weight of gaseous products, all of which were entirely lost. Now, Mr. Budd had satisfactorily proved, by actual experiment, that the heat which escaped from the tops of the blast furnaces was a matter which the iron manufacturer might turn to material account in the way of increasing his own profit, as well as in diminishing the price to the purchasers of that commodity.

Mr. Budd stated that, since the meeting of the Association at Swansea, he had continued, and with increased success, to apply the waste gases that escaped from the top of blast furnaces to the manufacture of iron; and it was the result of his farther experience applied to the whole of his furnaces (nine in number), since that period, that he now wished to submit to the section. When the British Association met at Swansea, he had not used the gaseous escape at any great distance from the furnace, his stoves and boilers being very closely contiguous. Further experience, however, had proved that by the aid of a stack at the end of the chain of sufficient dimensions, the gaseous escape from the furnace might be made to travel in the most tortuous directions, descending to the stoves built for heating by the usual fireplaces, and traversing the boilers; the only condition absolutely necessary being that there should be an unbroken communication with the high stack at the end, into which the gaseous escape might at last pass, and by which it was drawn forward, instead of passing off wastefully at the tunnel-head. When, however, the draft was carried downward, and to long distances, he had found it necessary to drop into the top of the furnace a hopper or funnel, made of sheet-iron, which acted as a

shield at the mouths of the horizontal flues, and prevented them from either being affected by high winds, or from being choked up by materials thrown into the furnace. The reason, no doubt, why this funnel was not applied before was the great apparent temperature at the tunnel-head. In practice, however, it was found that until the gaseous escape mingled with the atmosphere, its heating power was not such as to injure sheet-iron, or even to make it red-hot. In fact, so long as there was an escape upwards, the iron funnel would not be injured. The damage arose during and after stoppages of the furnace, when the blast was obstructed in its passage upwards by the settlement of the materials in the furnace, so that the atmosphere rushed down to meet the ascending gases, and, of course, caused a very high local temperature. His practice was to exclude the atmospheric air as much as possible. The affinity of the gases for oxygen was so great that the air leakage raised the temperature quite sufficient for safety, whilst the full combustion of the gaseous escape would melt down the bricks in the flues, and destroy the texture of the iron tube. It was not possible for him to say what combinations took place at high temperatures, where carbonic oxide, carbonic acid, hydrogen, and nitrogen, were mixed in such proportions. At any rate, he found a smothered combustion to be the most suitable and economical for the purposes in view. He was happy to say that, at length, the application of the gaseous escape had been tried in Scotland; and that at Dundyvan and elsewhere it was now in successful operation. The peculiar quality of the furnace coal of Scotland being what was called in South Wales "free-burning," which, when put into the furnace raw, coked sufficiently in its descent, gave out an enormous escape, so much so that, upon a rough estimate, he calculated that the waste from one furnace in Scotland was sufficient to heat the blast, and to raise the steam for three. With anthracite coal, the minimum effect was obtained, as it was a dense fuel of nearly 95 per cent. of solid carbon; but in Scotland there would be an enormous surplus at the tunnel-head. He expected, from the well-known sagacity of the Scottish people, that when truly embarked in this mode of operation the greatest possible use would be made of it; and he would not be surprised to see heat let out, like mill-power, for burning bricks and other similar purposes. He felt, however, anxious that the application should be made under the superintendence of competent parties, as he had known several instances where the plan had been abandoned from difficulties that might easily have been surmounted under proper directions. He was quite aware that, by the plan he had pursued, the utmost heat was not extracted from the gases; and that, by different means, a temperature might be obtained capable of performing all the operations of the forge; and if it be the solid carbon of the furnace in its escape, as carbonic oxide, would unite with another dose of oxygen or saturation, there could be little doubt that, with properly contsituted gas furnaces, there was enough at present passing off to convert the pig-iron into bar-iron. He hoped some of the iron-masters of Scotland would follow up this hint effectually with regard to the remaining processes required for making malleable iron. He observed that the saving at the Dundyvan Iron-works was stated to be about 1½ tons for each ton of iron produced. Supposing, therefore, 600,000 tons of iron to be the produce of Scotland, and supposing the value of the coal used to be 3s. per ton. the saving that would thus be effected on the make of Scotland, would amount to 112,500*l*. a year; to which might be added 20,000*l*. a year of saving in wages and repairs; which would make a total saving of 132,500*l*, or about 4s. 5d. a ton on the produce of Scotland, which on the present price of 44s. per ton, was about 10 per cent. on the value. If the gaseous escape could be extended to the uses of the forge, a farther saving of three tons of coal wouldbe effected—thus making, at least, a savingof 20s. a ton on all the iron manufactured into bars, sheets, and rails.

"THE CITY OF PARIS" STEAMER.

On Saturday last, the 10th inst., *The City of Paris*, a new and powerful iron steam ship of 425 tons burthen, belonging to the Commercial Steam Navigation Company, and intended to ply between London and Boulonge, was launched from the ship-building yard of Messrs. Joyce and Co., of Greenwich. She is, we believe, the first iron vessel of magnitude ever built at that place. Of her lines, it may be sufficient to say that they were supplied by that well-known and successful Government builder, Mr. Oliver Lang, of Woolwich.

The following are her principal dimensions:—

	Ft.	In.
Length between Perpendiculars.	165	0
Breadth of Beam............	23	0
Depth of Hold	14	0
Draught of Water	6	6

The engines are of the collective power of 120 horses, and are on the direct-action principle. Each piston has two rods, between which there is a recess in the piston which allows of a corresponding recess in

the cylinder covers, and thereby permits the connecting rods to descend considerably lower than is practicable in the *single-rod* direct-acting engine. The arrangement altogether is very compact and simple, and reflects great credit on the engineers, Messrs. Joyce and Co.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING AUGUST 15TH, 1850.

JOHN MACINTOSH, Berner's-street, Oxford-street, Middlesex, C.E. *For improvements in obtaining power, in the floating of bodies, and in conveying fluids.* Patent dated February 12, 1850.

Mr. Macintosh's present improvements in "obtaining power" refer to the flexible rotary engine which formed the subject of a patent granted to the same gentleman in June, 1848, and described in vol. l., page 18. The engine, as now improved, consists of a cylinder, the ends of which are closed by the flanges of an internal cylinder, which is made in two parts, with a circular space between the two ends opposite to each other, for the arm of the piston to work in. This arm is keyed on the main shaft, and the piston works in the space between the two cylinders, underneath an endless steel band which closes the space between the two portions of the internal cylinder. The steam is admitted to drive the piston, and subsequently allowed to escape by arrangements similar to those described in the specification of his former patent.

2. Mr. Macintosh describes another rotary engine, which consists of two moveable cylinders placed one within the other. The inner one is keyed on the main shaft, and fitted with a sliding piston, which is kept in contact with the interior periphery of the large cylinder by the action of a spring placed behind it. The cylinders are concentric, and their internal and external circumferences are brought into contact at the bottom by friction rollers—one at bottom and one on each side. For carriages it is proposed to have a rim on the end of the inner cylinder, and to attach the railway or other tyre thereto.

3. "The improvements in floating bodies" consist in making breakwaters for the formation of harbours, of sheets of net or wire, which are rendered buoyant by being done over with tar mixed with sawdust, or any other fibrous and buoyant materials. Also, in constructing moveable bridges, for the conveyance of troops across rivers or to ships, of a tube of India rubber or gutta percha bent into the form of a rectangle of the length required, and fitted with a valve. Strong pieces of wood are attached to the inner edges of the long sides, and form the foot-way. When required to be used, the tube is to be filled with air; and when out of use, it is to be rolled round a spindle mounted upon wheels, to facilitate its removal from place to place.

4. "The improvements in conveying fluids" consist in enclosing them in waterproof bags, and floating them to their destination, and are stated to be specially applicable for the conveyance of fresh water to ships at sea, or of sewage to a distance from towns.

Lastly, the patentee describes the adaptation to drains of an air and water-tight bag, the lower end of which is kept closed by a weight, except when any matters fall into it.

Claims.—1. The improvements in constructing engines for obtaining power.

2. The improvements in floating bodies for obtaining harbours, and also in portable bridges.

3. The improvements in conveying fluids.

WILLIAM BLINKHORN, Sutton, Lancashire, glass manufacturer. *For certain improvements in machinery to be used in the manufacture of glass.* Patent dated February 12, 1850.

The present patentee proposes to employ a hollow casting table, the upper part and sides being cast in one piece, with flanges which are riveted to the bottom plate. A stream of water is to be kept running through this table. In the lower part of the table there are ovens for the purpose of heating the water and the top plate to about 120° Fah., to prevent injury to the plate when the metal is first poured from the crucible or pot on to the table. When, after repeated castings, the top plate of the table has been heated, the fires are raked out, and the temperature kept down to the required degree by the stream of cold water running through, or by means of several jets of cold water, which are caused to play against the under surface of the top plate. The table is mounted on wheels which run on rails, to facilitate its removal from one annealing kiln to another. The rolling cylinder is supported above the table on adjustable tangs, for the purpose of regulating the thickness of the plate, and is fitted on each side with guides for determining the width. The cylinder is made to travel to and fro on the table by means of a pitch chain connected to its brasses, which goes round a pitch wheel driven alternately in opposite directions by means of the ordinary reversing gear, placed in front of the kiln, and actuated from a prime mover. To each side of the cylinder there is attached an arm connected to a lever which has a notch in the upper surface nearest the kiln, into which

takes a projection on the under surface of a cross sliding piece attached to a chain passing over a pulley, and weighted at the other end. The opposite ends of the levers are furnished with friction pulleys, and the corresponding end of the table is fitted with inclined planes. At the commencement of working, the table is raised to the requisite degree of temperature, and the rolling cylinder drawn back to the end nearest the kiln, upon which the metal is emptied on to the casting table. The cylinder is then made to travel over the metal from the kiln, carrying the sliding piece with it, which is raised above the surface of the plate. When it arrives at the end, the friction pulleys ascend the inclined planes, and, by causing the notched ends of the levers to be depressed, liberate the sliding piece, which is drawn back by the reaction of the weighted chain, and thereby forces the plate into the annealing kiln.

Claims.—1. Constructing casting tables, used in the manufacture of glass, in such manner as that their working surfaces may be raised to and maintained at the suitable degree of temperature by water.

2. Constructing and arranging machinery, used in the manufacture of glass, in such manner as that the plates shall be rolled thereby upon the casting table.

3. Constructing and arranging machinery, used in the manufacture of glass, in such manner as that the plates shall be transferred thereby from the casting table to the annealing kiln.

James Webster, Leicester, engineer. *For improvements in the production of gas for the purposes of light.* Patent dated February 12, 1850.

These improvements relate to an apparatus for the manufacture of coal or resin gas, which Mr. Webster terms "a domestic gas generator."

1. This "generator," when coal is used, consists of three retorts, supported in a suitable setting, two of which are charged with coal in the usual way, with the exception of a portion of the length near the end of each, which is separated from the rest by a perforated plate, and filled with pieces of iron and black lead in powder. In the upper part of the setting there is a boiler, in which steam is generated at a pressure a little above that of the atmosphere. The steam is conducted by pipes into the small end chambers, and carries thence the black lead into the retorts, depositing it upon their interior surfaces, and thereby preventing their being deteriorated by its action. The three retorts and boiler are heated by one furnace. The gaseous products and steam escape from these two retorts into the third, where such portions as have not been transformed into gas are completely evolved, after which they pass into a condenser, where the steam is condensed, and the gas escapes to the gasometer.

2. The "generator" for resin-gas is very similar to the preceding, with the exception that the third retort is filled with pieces of iron and black lead in powder, into which steam is admitted from the boiler, passing thence into the other two retorts that are supplied with melted resin from a reservoir in the upper part of the setting. The steam and gas then pass to a condenser, where the former is condensed, after which the latter escapes to a gasometer.

Claims.—1. The improvements in the manufacture of gas from coal, as described.

2. The improvements in the manufacture of gas from resin, as described.

Read Holliday, Huddersfield. *For improvements in lamps.* Patent dated February 11, 1850.

Mr. Holliday describes and claims several constructions of lamps in which light is produced by the ignition of vapour evolved by heating some suitable spirit supplied to the burner from a reservoir by capillary attraction.

The following are the principal features of novelty—

1. The use of two discs of cork, or other non-conductor of heat, to maintain the burner-tube in position, and impede the transmission of its heat to the glass or earthenware reservoir of spirits.

2. The employment of a cock or tap situated below the jet orifice, for the purpose of regulating the supply of vapour to the burner. Several arrangements are specified to be used, instead of the cock, having for their object a like purpose, namely, the regulation of the supply of vapour. One consists of a fixed spike, which passes through an opening in the bottom of the burner tube, and, as the latter is moved up or down, increases or diminishes the size of the opening, and therefore of the supply of vapour. This spike also serves to clear the jet orifice. Or, a valve with a conical passage, which answers the double purpose of regulator and jet orifice, may be made use of.

3. The employment of perforated burners and wick-tubes for the admission of air to the vapour.

4. Enlarging the lower part of the burner underneath which the wick is to be spread out, for the purpose of increasing the heated surface. Also, the use of a two-legged wick tube, through which the wick is drawn, or of two wicks for obtaining a like effect.

5. Various modifications of the preceding

arrangements are described, whereby two or more burners are combined in one lamp, or the vapour supplied from two or more sources is centred in one light.

6. Regulating the admission of air to the vapour by making the burners to turn round the top of the wick tubes, and perforating such portions as are in contact with each other, so that when the holes are coincident the supply of air will be at its maximum, which will be gradually decreased as the burner is turned in one or other direction, and will be totally cut off when the perforations of the one come opposite the unperforated portions of the other.

7. Several methods of constructing the burners and wick tubes, to admit of their being cast in one piece.

8. The adaptation of an adjusting screw to the wick tube, to compress the fibres between it and the side of the tube, for the purpose of regulating the supply of spirit to be vaporised.

9. The patentee proposes to employ an arrangement, similar to that last mentioned, in pressure spirit lamps, for the purpose of compressing more or less the fabric through which the spirit is generally filtered and supplied from the reservoir to the burner.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
August 9	2403	H. C. Windle, and W. D. Blyth	Walsall	Latch.
10	2404	Susan Hooper and Co.	Birmingham	Registered stove top.
12	2405	Thos. and Chas. Clark,	Wolverhampton	Spring hinge.
13	2406	Capt. W. H. Armstrong,	Cobham, Surrey	Rose-tree and flower girdle.
15	2407	D. Y. Steward and Co.	St. Rollox, Glasgow	Core carriage.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Joseph Steele, of Chancery-lane, for improvements in coating and impregnating metals and metallic articles. (Being a communication.) August 9; six months.

Henry Meyer, of the Strand, Middlesex, gentleman, for certain improvements in power looms for weaving. August 10; six months.

Selim Richard St. Clair Massiah, of Aldermen's-walk, New Broad-street, London, for improvements in the manufacture of artificial marble and stone, and in treating marble and stone. August 10; six months.

Alfred Holl, of Greenwich, Kent, engineer, for improvements in steam engines. August 12; six months.

Armand Nicolas Frèche, merchant, residing in Paris, for improvements in obtaining power. August 12; six months.

Charles Cadby, of Liquorpond-street, Middlesex, pianoforte-maker, for improvements in stringed musical instruments. August 12; six months.

George Thompson, of Park-road, Regent's-park, Middlesex, gentleman, for certain improvements in machinery and apparatus for cutting, digging, or turning up earth, applicable to agricultural purposes. August 12; six months.

Samuel John Pittar, of Church-place, Clapham, Surrey, civil engineer, for certain improvements in umbrellas and parasols. August 13; six months.

Peter Claussen, of Great Charlotte-street, Blackfriars, Surrey, manufacturer, for certain improvements in bleaching, and in the preparation of materials for spinning and felting, and in yarns and felts. (Being a communication.) August 16; six months.

William Keates, of Liverpool, merchant, for improvements in machinery for manufacturing rollers and cylinders used for calico printing, and other purposes. August 16; six months.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1411.] SATURDAY, AUGUST 24, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. DONKIN AND FAREY'S IMPROVEMENTS IN STEAM ENGINES.— IMPROVED EXPANSION GEARING.

Fig. 13.

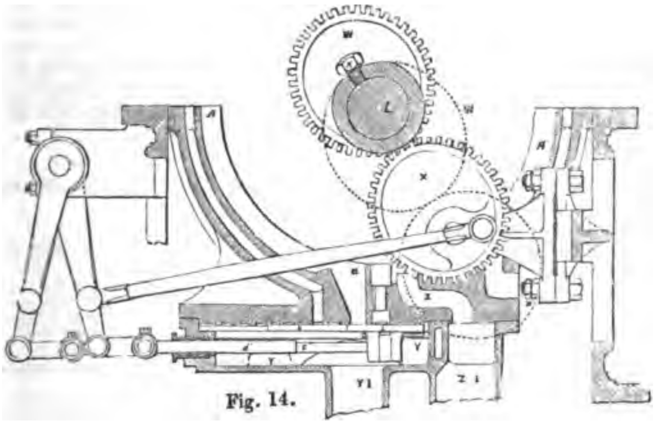
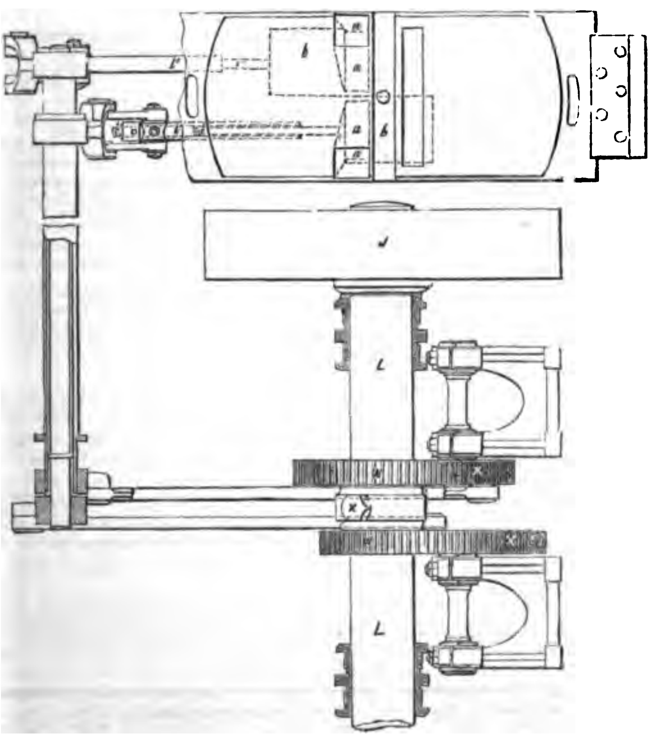


Fig. 14.



MESSRS. DONKIN AND FAREY'S IMPROVEMENTS IN STEAM ENGINES.—IMPROVED EXPANSION GEARING.

Specification.

(Concluded from page 124.)

Fourthly. Our invention consists of an improved method of working expansion valves, which is applicable both to the disc engine and generally to all rotary or semi-rotary engines.

Fig. 13 is a cross section through the centre of a disc engine with our improved expansion apparatus applied thereto.

Fig. 14 is a plan of the engine with the cover and cones removed so as to exhibit the bottom of the cylinder only. A is the cylinder; L the main shaft; J the driving crank; WW are eccentric toothed wheels of an elliptical form, which are fixed on the main shaft L (by means of the set screw *x*) and work into and drive another set of similar wheels XX, —which last work the slide valves *bb*; *aa* are the ports by which steam is admitted to the two sides of the disc; y^1 the pipe which conveys the steam from the boiler to the slide-valve box *y*; *z* is the exhaust passage, and z^1 the exhaust pipe. To adjust the apparatus, the engine is first set at one half of that part of the revolution at which it is desired to cut off the steam; the wheels WW are then adjusted (by means of the set screw *x*) so that the point thereof furthest from the centre of the main shaft shall be in gear with the wheels XX at the point nearest to the centre of the shaft on which they work; the engine is next turned to that part of the revolution at which the steam is required to enter the cylinder and the slide valves *aa* adjusted (by means of the set screws *c′c′* and nuts *d′d′*), so as to be just on the point of uncovering the steam ports *aa*. Matters having been thus arranged and the engine set to work, we are enabled by the elliptical shape given to the eccentric wheels WW and XX, and the relative positions in which they are placed, to cut off the steam at any point whatever of the revolution that may be most advantageous; and this because, for every small portion of a revolution performed by the wheels WW, the wheels XX, which move the slide valves *bb*, necessarily perform a large portion of a revolution; that is to say, in consequence of the gearing point of the two sets of wheels being at the point farthest from the centre of the main shaft, a small portion of a revolution of the wheels WW suffices to make the slide valves, which are moved by the wheels XX, travel a sufficient distance to open and shut the steam ports *aa*.

The face on which the slide valves work is made with grooves or recesses (as shown in figs. 2, 3, and 13,) in order that by the admission of steam into these grooves or recesses the pressure of the steam upon the back of the valve may be more or less counteracted.

Fifthly. Our invention consists of an expansion apparatus on the same principle as the preceding, but adapted to steam engines of all sorts. Fig. 15 is a longitudinal section through the centre of so much of a steam engine of the ordinary reciprocating sort as is necessary to explain this application. Fig. 16 is a front view of the same with the back of the slide boxes removed, in order the better to show the slide valves. WW and XX are two pairs of elliptical eccentric wheels as before, the former of which are fixed on the main shaft L, and gear into the latter which work the slide valves *bb* at the back of the slide box e^1 of the ordinary slide valve *f*; g^1 is the steam pipe. The different parts act precisely in the same way as the corresponding parts in the arrangement last before described, and are also adjusted in the same manner.

Sixthly. Our invention consists of a new sort of metallic packing, which may be substituted for the hempen and other soft packings now in common use, and applied to all descriptions of steam engines. We make this packing of shavings, cuttings, or filings of tin, zinc, or other soft metal, or soft metallic compound, and compress these together round the piston or other part required to be packed, in the same way as hemp is now ordinarily done. We are aware that it has been before proposed to line the bearings of journals and axles with soft metal, but the use of soft metal for the purpose of making the pistons and stuffing boxes of steam engines, steam-tight, as here proposed, we believe to be new.

[Messrs. Donkin and Farey also describe a fluid meter constructed on the same principle as the disc steam engine.]

Claims.—First. We claim the employment of the inner or additional glands, GG, for the purpose of packing the ball of disc engines, the ring of metal H, for securing the ends of the packing slips, *cc*, and the peculiar sort of bearing in which the coned end of the diagonal shaft D is stepped, each as before described.

Second. We claim the employment in disc engines of the improved description of metallic packings represented in figs. 9 and 10, and before described.

Third. We claim the construction of disc engine represented in figs. 11 and 12, and

before described, that is to say, in so far as regards the mode or means by which the diagonal shaft D is connected at the outer end to the driving crank, and caused to keep the disc up to the cones, whereby the usual metallic packings are, or may be, wholly dispensed with.

Fourth. We claim the employment in the disc engine, and in rotary and semi-rotary engines generally, of the arrangement of expansion gear represented in figs. 13 and 14, and before described, that is to say, in so far as regards the elliptical shape of the eccentric wheels, WW, and XX.

Fig. 15.

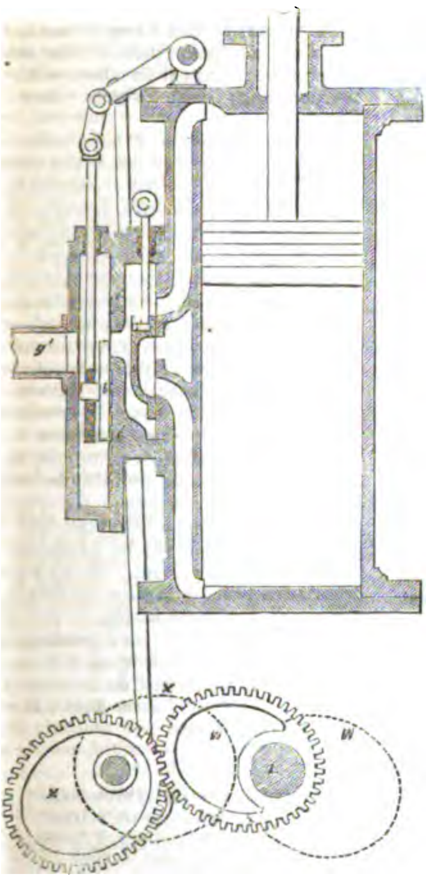
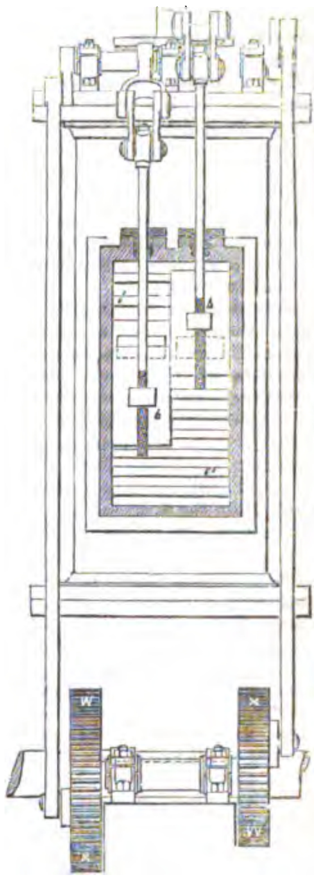


Fig. 16.



Fifth. We claim the construction of the face on which the slide valves work, with grooves or recesses to contain steam, for the purpose of counteracting the pressure on the back of the valve as represented in figs. 2, 3, and 13, and before described.

Sixth. We claim the adaptation of the peculiar expansion arrangement before described, to the ordinary and other steam engines, as exemplified in figs. 15 and 16.

Seventh. We claim the making of the packings of the pistons and stuffing-boxes of steam engines,—of the shavings, cuttings, or filings of tin, zinc, or other soft metal, as before described.

And, *Eighth.* We claim the fluid meter on the disc principle before described, in so far as respects the adaptation to such fluid meters of the several improvements before specified and claimed, all or any of them.

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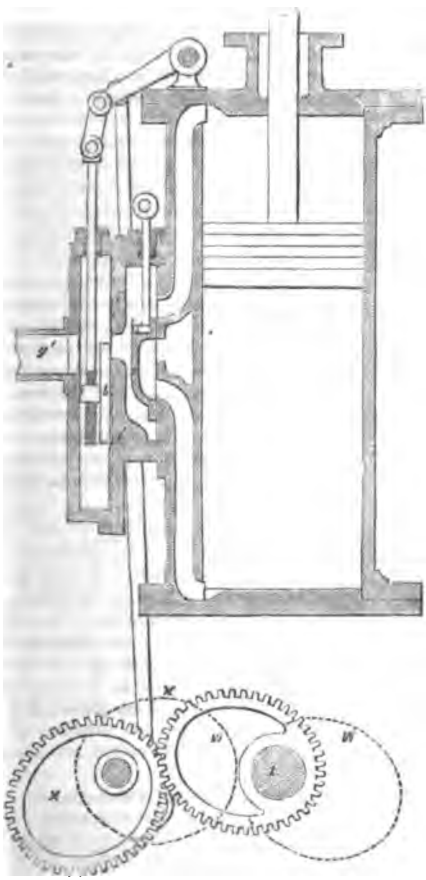

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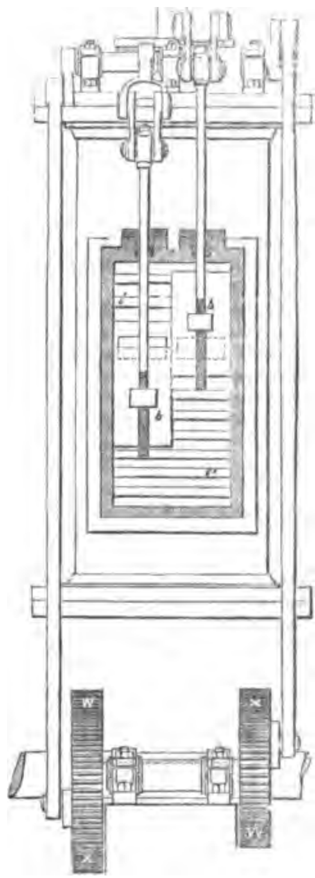

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FORMATION OF PEBBLES OR SHINGLE.

Sir,—The article in your last Number —"On the Incrustations which form in the Boilers of Steam Engines"—particularly those which make use of sea-water, has reminded me of some facts which have come under my notice as a resident on the sea-coast, in reference to the formation of the pebbles or "shingle," which constitute so excellent a bulwark against the encroachments of the sea.

The common hypothesis by which their formation is accounted for is, that they are formed by the mechanical action of the waves from the *debris* of the coasts; and, to a certain extent, this is doubtless true. But there is also an idea somewhat prevalent among the dwellers on the shore, that pebbles *grow;* and this, it appears to me, has its modicum of truth also.

Some three or four years since, Mr. Major Vidler, surveyor of Pevensey level, in one of his Reports to the Commissioners of that level, made some remarks tending to show that the large banks of shingle to which the marshes under his care owe their security from inundation, are formed from the ruins of the chalk cliffs of Beachy Head,—not merely from the flints which those ruins contained, but also from the chalk itself; which he supposed might be carried out by the ebb tides into deep water, and being there subjected to great pressure, became impregnated with the silicon held in solution by the sea-water, and thus converted into flints, which, in course of time, were thrown on shore again.

The Report which contained these ideas was published in one of the Sussex papers, and the theory which they advanced was attacked through the same medium, by Dr. Mantell, the geologist, whose "Thoughts on a Pebble" had then been recently published.

The facts, however, upon which Mr. Vidler founded his views, remain the same as before, and possibly they may lead to some useful result if placed before your readers.

I can only state them generally, and so far as my own observations confirm them, because I have not seen the Report I have alluded to, since the time of its publication.

In the first place, the form of most of the pebbles seems to indicate that they were in a plastic state when first subjected to the action of the sea, and that they have become hardened by the sea-water.

Few of them are round—most of them incline to a "kidney" shape, such as one might expect a lump of tough clay to assume if constantly agitated in water, or sometimes in and sometimes out of water.

In support of this I may remark, that the pieces of fresh chalk on this side of Beachy are identical in shape with the boulder flints with which they are mingled.

In the next place, I have seen, and can find at any day upon the beach, pieces of chalk partially consisting of flint, some of them with scarcely perceptible nuclei, as if the flint-forming agency had only just commenced its work.

I may add to this, that the same thing may be seen in various other substances, as clay—sandstone, green and red—coal—brick; indeed, almost everything of mineral origin appears liable to be changed into flint under the action of the sea.

In some cases I have observed two flinty nuclei in the same specimen.

Long-continued observation and careful experiment would probably be necessary to determine whether the change (supposing it to be admitted on the grounds I have stated) be produced by "pressure from without," or by an appropriative process having its origin in some centre of force within.

Perhaps some of your readers can throw light upon the subject.

I am, Sir, yours, &c.,

JAMES ROCK, JUN.

Hastings, Aug. 20, 1850.

MATHEMATICAL PERIODICALS.

(Continued from page 448, vol. LII.)

XXII. *Miscellanea Curiosa Mathematica.*

Origin.—This periodical was commenced in the eventful year 1745, in consequence of "the Editor of the *Gentleman's Magazine* having been solicited, by several ingenious Mathematicians, to insert into it so many of their pieces as would have disgusted the far greater part of his readers."—However, "while he complied with the taste of the *polite* and *gay*, the *politician* and the *patriot*, he thought himself indispensably obliged

to consider likewise his friends of a more philosophical disposition, and therefore he readily joined in a scheme for publishing such productions once a quarter in a separate pamphlet." He further states that he did this the more readily, since in the annual *Diaries*, "too little room is allowed for solutions at large to questions worthy of consideration: a defect and inconvenience, which it is the intention of this work to provide against." The first volume was completed in 1749, and was dedicated "to John Bristow, of Clumber Park, in the county of Nottingham, Esq.;" who is told in the somewhat fulsome dedication, that "this collection of mathematical disquisitions is designed to render the mathematics more familiar and intelligible, and to bring this part of learning into a narrow compass, and so leave more room for cultivating the mind with moral knowledge and virtue!" Of the second volume only five numbers were printed, and as one of the articles in the last number bears date, Feb. 25, 1753, it may reasonably be inferred that the work was discontinued about this period. Some former possessor of the volumes furnishes a confirmation of the preceding opinion, for he has added at the end of number 5, vol. ii., the M.S. observations. "*Completing* 14 *Nos. Exit.*" The work is printed in small quarto, vol i. containing xvi + 312; and vol. ii., 186 pages.

Editor. — "Mr. Francis Holliday, Master of the Grammar Free School at Haughton Park, near Retford, Nottinghamshire." Author of a "Treatise on Fluxions," &c., &c.

Contents.—As might be inferred from the circumstances which gave rise to this periodical, it is wholly devoted to mathematical subjects. Each number contains a series of original and selected papers, on most of the subjects which usually engaged the attention of the mathematicians of that date, together with a selection of mathematical questions and solutions. In several of the earlier numbers solutions are given to most of the questions proposed in the *Gentleman's Diary* and *Supplement* for the time being; but as the number of correspondents increased, this practice was discontinued. Many of the papers were of primary importance at the time of their publication, and the following enumeration will show that some of them, even at the present day, possess considerable interest.

Art. I. Of the proportion of velocity and forces in bodies in motion. *Phil. Trans.*, No. 401. By Dr. S. Clarke.

Art. II.—A Table of the times when the paths of the Satellites of Jupiter and Saturn become convex toward the Sun. Also a Method proposed for demonstrating the Earth's Motion and investigating the Parallaxes of the Sun and Planets. By X. Y.

Art. III.—A Demonstration of four Theorems for determining accurately the Sun's Parallax. By Mr. N. Facio Duillier, F.R.S.

*** In this paper several properties of the *harmonical* division of the diameter of a circle are introduced, especially that upon which Prop. 2, Dr. Simson's *De Porismatibus* is founded. It is also worthy of notice that Mr. Duillier applies the term *pole* to those points (with respect to the circle) which afterwards received the same designation by M. Servois, in reference to the conic sections generally.

Art. IV.—A universal spherico-catoptric theorem, translated from the Latin in No. 295 of the *Phil. Trans.* By F. Holliday.

Art. V.—Reduction of Algebraic fractions into more simple ones, and recurring series. By Mr. Abraham De Moivre, F.R.S. No. 373, *Phil. Trans.* Translated by Mr. Holliday.

*** In addition to several useful theorems relating to rational fractions this paper also contains "the section of an angle which the acute Mr. De Moivre hit upon," translated from No. 374 of the *Phil. Transactions.*

Art. VI.—A Theorem on Increments, with its demonstration. Translated from the Latin of Dr. Taylor's *Methodus Incrementorum.* By Mr. Holliday.

*** This paper contains the *original* statement and demonstration of Taylor's Theorem, as adapted to Increments and Decrements generally. In the *second* corollary the Fluxions proportional to the evanescent Increments are introduced, in place of the Increments themselves, and hence the Theorem is deduced in the form in which it is usually given by writers on the Fluxional and Differential Calculus.

Art. VII. — Tables of Annuities, founded on the Bills of Mortality for London. By Mr. B. Darting.

Art. VIII.—Of the *Maxima* and

Minima occurring in the Celestial Motions. By that sagacious mathematician, Mr. Ab. De Moivre, F.R.S. Done into *English* from No. 360 *Phil. Trans.* By Mr. Holliday.

Art. IX.—An Essay to find the Sun's horizontal parallax by the transit of Venus over the Sun's Disc. By Mr. Alex. Findlay, teacher of Navigation at Aberdeen.

Art. X.—Solutions to Sixteen Questions from the *Supplement* to the *Gentleman's Diary*. By Mr. Samuel Farrer, of London.

Art. XI.—Solution to Ques. 264, *Ladies' Diary* for 1745. By Merones (Emerson).

Art. XII.—Solutions to Three Questions from the *Gentleman's Magazine*. By Messrs. Turner, Cleophilus, and Anglewitch.

Art. XIII.—An Essay concerning the sums of the powers of Arithmetical progressions, with its application to the solution of Ques. 258 in the *Ladies' Diary* for 1745. By Spicelegus, gent.

Art. XIV.—Solutions of Ten Questions from the *Gentleman's Diary*. By Messrs. Robinson, Farrer, Waine, and Williams.

Art. XV.—The Demonstrations of the Theorems in Art. III. rendered complete. By Mr. Nic. Facio Duillier, F.R.S.

Art. XVI.—A Table of Chances for any number of points thrown with 1, 2, 3, &c., up to 12 Dice inclusive, and the Method of Computation. By Mr. Richard Gibbons.

Art. XVII.—An Essay on the Properties of Triangles inscribed in, and circumscribed about, two given Circles. By Mr. William Chapple.

⁂ This paper contains several curious and interesting properties of the inscribed and circumscribed circles, amongst which is the well-known expression for the distance between their centres, viz., $\delta^2 = R^2 - 2Rr$, here given for the first time by Mr. Chapple. The same subject also forms the subject of the Prize question in the *Ladies' Diary* for 1746. It was proposed by Mr. Chapple in order to draw attention to his Essay, and was answered by Mr. Robert Heath, the then Editor of the *Diary*, who claims for himself the honour of having "discovered this property of drawing triangles about circles some years ago, as may be seen in the *Monthly Oracle*." He, however, acknowledges that the proposer "has greatly deserved, in his long account of it in the *Miscellanea Mathematica*; and as Mr. Chapple does not appear to have raised any objections to these remarks, most probably Mr. Heath's claim is worthy of consideration. Mr. Landen took up the same inquiry in his *Mathematical Lucubrations*, published in 1755, and added a considerable number of curious properties, besides extending some portions of his results to the conic sections. His discussion occupies twenty-four quarto pages, but he neither mentions the rival claimants nor the works in which their investigations appeared. From this period, the various properties were well known to the mathematicians of this country, but do not seem to have found their way to the continent; for they were proposed as *new* to the correspondents of the first volumes of Gergonne's *Annales des Mathematiques* for 1810-11. In this work several solutions to the principal property are given by L'Huillier, Garnier, and the Editors, who also proposed for demonstration two porisms which had occurred to them during the course of their investigations, both of which are given by Professor Leybourn in his edition of the *Ladies' Diary*, vol. iv. pp. 340-1. Dr. Wallace gave an analytical, and Professor Lowry a geometrical, determination of the expression for the distance between the centres, in the pages of the *Diary* just cited, and many others might be pointed out in various works; but by far the most elegant and comprehensive are those given by Professor Davies, in Prop. XIII.; XIV.; *Horæ Geometricæ*, 1835; and pp. 414-15, of his *Solutions to Hutton's Course*.

Art. XVIII.—Calculation at large of the Eclipse of the Moon, August 19, 1746, from Flamstead's Tables. By Thomas Sparrow.

Art. XIX.—Solution of Ques. 161, *Ladies' Diary* for 1731, which had hitherto remained unanswered. By Edward Hauxley.

Art. XX.—Of finding Fluents by that excellent Table in Mr. Emerson's Fluxions. By F. Holliday.

Art. XXI.—Two new measures subservient to Mechanical Practice. Translated from the Latin of M. C. Polhem. By F. Holliday.

Art. XXII.—Concerning a very curious Astronomical Problem for finding the place of a Comet, from having given the latitudes and longitudes of four fixed stars. By Edward Hauxley.

Art. XXIII.—Observations of the Comet of 1743-4. By S. B(olton), of Cambridge.

Art. XXIV.—Concerning an octave on the Monochord, divided by geometrical proportionals. By Philo-whimsicolos (*probably Emerson*).

Art. XXV.—A Table showing some of the properties of regular Polygons. By Polygonus.

Art. XXVI.—The quadrature of the figures of tangents and secants, by the hyperbolic logarithms. By H(olliday).

Art. XXVII.—An Essay on Fluxions, wherein the first principles are clearly demonstrated in a very easy and concise Method, adapted to Beginners. By Archimedes.

Art. XXVIII.—How to solve all manner of simple Fluxionary exponential problems. By Edward Hauxley.

Art. XXIX.—A Table showing some of the properties of regular solids. By Polyedra.

Art. XXX.—This is Art. XX. continued.

Art. XXXI.—Concerning the right ascensions and declinations of the Comet of 1743-4. By S. B(olton).

Art. XXXII.—An Essay on the Calendar, with regard to the correction of the Julian and Gregorian accounts in the celebration of Easter. By H(olliday).

Art. XXXIII.—This is Art. XXX. continued.

Art. XXXIV.—An Easy Construction and Calculation of a Problem for determining the places of a Comet. By the Rev. Stephen Bolton, M.A.

Problem.

"Four right lines being given in position, *viz.*, FC, GA, HB, IC, it is required to find a fifth (FI), which shall be cut in the points G and H in any given ratio."

A Geometrical Construction and a Trigonometrical Calculation are given by the proposer.

Art. XXXV.—Calculation at large of the Eclipse of the Sun, July 14th, 1748, for London and Newcastle, from Brent's Tables. By Mr. R. Robinson.

Art. XXXVI.—Calculation of the same, by Mr. Machin's numbers in Brent's Tables. By William Brown.

Art. XXXVII.—A Table exhibiting where the central Annulus is conspicuous in the same Eclipse. By Mr. Thomas Cowper.

Art. XXXVIII.—A Theorem relating to the comparison of the weights of bodies, from Prop. 20, B. iii., *Newton's Principia*, demonstrated.

Art. XXXIX.—A New Proposition in Geometry demonstrated. By Mr. William Chapple.

⁎ This proposition is the now well-known property, that "the three perpendiculars of any triangle intersect in the same point," and although taken for granted in the solutions of Ques. 45, *Gentleman's Diary* for 1743-4; Ques. 260, *Ladies' Diary*, 1745-6; the honour of a *formal* enunciation and demonstration appears to be due to Mr. Chapple. The property is stated both for the acute and obtuse angled triangle, "the same demonstration serving for both," which, however, is not conducted in so purely geometrical a manner as one could wish. Many proofs of this property may be found in most treatises on Co-ordinate Geometry, especially in *Davies's Hutton*, vol. ii., pp. 269-272, where *six* different solutions are given; but the most extensive discussions of the relations which exist between the perpendiculars, the segments of the sides, the angles, and the sides of any triangle, are to be found in Carnot's *Geometrie de Position*, and more recently in the *Horæ Geometricæ* by Davies and Weddle.

Art. XL.—This is Art. XXXIII. continued, with a set of Tables entirely new. By F. Holliday.

Art. XLI.—A useful and general proposition for finding Fluents. By Mr. J. Powle.

Art. XLII.—A Scholium entirely new, showing how Cardan's Theorems for Cubic Equations are deduced, illustrated by examples. By H(olliday).

⁎ This paper professes to be an improvement "of what is inserted in pp. 186-7 of the second edition of *Ronayne's Algebra*," and merely consists in throwing the usual expressions for the roots of a cubic into infinite series by means of the Binomial Theorem. The following examples are given in illus-

tration. If $a^3-1203a=16000$; then $a=40 \cdot 03332407664$. If $a^3-15a=4$; then $a=-\cdot 2679491$.

Art. XLIII.—An Essay on the Golden Number; Cycle of the Sun; Roman Indiction; the Julian and Dionysian Periods, &c. By William Brown.

Art. XLIV.—A Specimen of a general method of drawing Tangents to Curves, deduced from the Doctrine of Maxima and Minima. By Mr. William Jepson.

Art. XLV.—Emendations and Corrections to Ques. 15; 47; and Art. XXXII. By Mr. William Chapple and an "Unknown Hand."

*** The preceding articles are contained in Nos. I. to IX. inclusive; forming the first volume of the work.

Art. XLVI.—A Table of Chances, intended as a plain and easy introduction to Simpson's Treatise on that subject. By Mr. Richard Gibbons.

Art. XLVII.—The investigation of two series furnished by Mr. Anthony Thacker for pages 100 and 109 of Shirtcliffe's Guaging. By Mr. F. Holliday.

Art. XLVIII.—This is Art. XL. continued.

Art. XLIX.—A general proposition for finding Fluents.—By Mr. John Powle.

Art. L.—Essay towards a Discovery of the Longitude by the Variations of the Magnetic Needle. By Edward Hauxley.

Art. LI.—A construction of Logarithms. By Mr. W. Bevil.

Art. LII.—This is Art. XLVIII. continued.

Art. LIII.—A Translation of Dr. Brook Taylor's Treatise on Increments. By F. Holliday.

*** This translation is continued in the next two numbers of the *Miscellanea*, and *ten* propositions were completed when the work was discontinued, the *seventh* of which contains what is usually known as Taylor's Theorem.

(*To be continued.*)

THE BRITANNIA TUBULAR BRIDGE.—MR. FAIRBAIRN THE TRUE INVENTOR.

The last Number of the *North British Review* has a very remarkable article on this subject, which is said to have been written by Sir David Brewster, and bears strong internal evidence of coming from his powerful pen. In a former notice of the Britannia and Conway Tubular Bridges, the *North British* ascribed the whole merit of their invention and construction to Mr. Robert Stephenson—induced thereto by the following considerations:—

"We were led into *this mistake* by taking our information from two different sources, in which the name of that eminent engineer was alone mentioned. One of them—probably copied from the other—bore no marks of authenticity; but the other* bears to be written 'by a resident assistant, with the permission of Robert Stephenson, civil engineer.' In this pamphlet the name of a coadjutor or colleague *is never once mentioned*, although the names of inferior assistants, builders, contractors, and mechanists in wood, stone, and iron are liberally emblazoned. That this pamphlet was written not only by the permission of Stephenson, but was intended to assert indirectly his claim to be the sole inventor of tubular bridges, is placed beyond a doubt by the address which he delivered at the entertainment given at Conway, in May, 1848, on the completion of one of the great tubes. He there distinctly assumes to be the sole inventor, and merely mentions the name of a gentleman as a person *whom he had employed* to test experimentally the theory he had formed. This gentleman was Mr. Wm. Fairbairn, of Manchester—an eminent engineer, *without whose genius and practical knowledge, and patient experimental inquiries* (the Reviewer is now convinced), *the tubular bridges in Wales could never have been constructed.*"

The writer has, therefore, taken up the matter anew, and gone at great length, and with great ability, into the whole "history of this great invention," the merit of which he thus honestly and magnanimously restores to Mr. Fairbairn:—

"Such is the tubular bridge which Mr. Stephenson has the undoubted merit of suggesting. No Englishman anticipated him in this idea, though it may appear afterwards that a Frenchman did. Mr. Fairbairn willingly concedes this specific merit to Mr.

* "General Description of the Britannia and Conway Tubular Bridges on the Chester and Holyhead Railway. Published with the permission of Robert Stephenson, Civil Engineer. By a Resident Assistant. London: 1849. pp. 34.

Stephenson; and it is probable that the public would have magnified its amount had not his injudicious friends claimed for him much more. Had Mr. Stephenson coupled the name of Mr. Fairbairn with his own, as conjoined in the execution of this great work, they would have shone together as a double star, commanding the esteem of future ages, and securing for their common country the honour of having produced such magnificent structures; but the minute investigation of their individual merits which has now become necessary, may lead to a very different apportionment of fame, and possibly allow a stranger to place himself in the eyes of the world as the earliest proposer of a tubular bridge.

"It is very clear, from the examination of Mr. Stephenson himself, that the idea of a tubular bridge was one which he was driven to adopt from necessity, and not from any knowledge that he possessed either of the theory of such a structure, or of any analogous works, on the authenticity of which he could have appealed to experience. When he tells the Committee that he is satisfied that the scheme is practicable and safe, he acknowledges at the same time that he adopts it because 'he must confess that he cannot see his way at present to adopting anything else.'

"An idea, adopted as a last resource, unsupported by theory, and untested by experience, is submitted to Mr. Fairbairn, *and in his hands* IT BECOMES A GREAT INVENTION, AND IS EXECUTED ON THE AUTHORITY OF PRINCIPLES WHICH HE HAS ESTABLISHED, AND OF PRACTICAL RESULTS WHICH HE HAS EXPERIMENTALLY OBTAINED. Mr. Stephenson as the engineer of the railway, has of course a general supervision of every thing connected with the bridges, corresponding occasionally with Mr. Fairbairn; but in so far as we can find, and we have been most anxious in our search, *he* (Mr. Stephenson) *has suggested nothing, and done nothing which can be considered as a part of the gigantic mechanism which now spans the Conway and is about to span the Menai Straits.*"

Our readers will observe that reference is made to the claims of a certain Frenchman as possibly conflicting with those both of Mr. Fairbairn and Mr. Stephenson. The Reviewer afterwards shows, however, that there is nothing in them. The Frenchman referred to is Dr. Jules Guyot, who patented a peculiar construction of girder in France in 1844, and in England in 1846.

"In his French patent he (Guyot) proposes to construct bridges with a number of cells or hollow parallelopipeds, formed either of bars or frames of iron united by pins, or formed of one piece of cast iron. An assemblage of these parallelopipeds or cells would form a hollow rectangular tube open on all its four sides. It is of no consequence, according to Dr. Guyot, how the form is obtained, because it is the form of the hollow or cellular solid that develops the strength of the iron, and consequently it is the form which constitutes the invention, and not the manner of executing it. * * Dr. Guyot's claim, however, does not in the slightest *degree affect the rights of Mr. Fairbairn, who claims only the merit of what he actually did*—of having shown by experiments on a large scale, that the *rectangular tube was preferable to the cylindrical and elliptical forms*—that a tube with its sides and top and bottom ALL SIMILAR *was not the form that should be adopted—and that a cellular top and a cellular bottom different from the top were necessary to give the requisite strength to the tubular bridges.*" (Besides all which) "Dr. Guyot never proposed that his (parallelopipedal bars or frames) SHOULD BE ROADS EITHER FOR MEN OR FOR RAILWAY TRAINS; they were merely intended for beams TO SUPPORT ROADWAYS OR ANALOGOUS STRUCTURES."

We have been altogether much gratified by the perusal of this article, which does infinite credit to the candour, impartiality, and good feeling of the writer; a gratification heightened not a little by the reflection that his judgment on the points in dispute is in entire conformity with that to which we had ourselves been previously led by an independent consideration of the case—(see *Mechanics' Magazine*, volume li., page 12) Mr. Stephenson and his partizans have committed themselves too absolutely, and, to say the truth, too audaciously, to the *Fairbairn sacrifice*, to be expected at this time of day to retract; but a retractation however ample, and however humble, were better far, than to persist in a course of misappropriation, which the more it is persisted in, and the more it is probed and sifted, will only cover him and them with more and more disgrace.

GEOMETRICAL NOTES.* BY T. S. DAVIES, ESQ., F.R.S., F.S.A., ETC.

I. *The Early Geometry of the Greeks and Egyptians.*

So much has been said on this subject by almost every writer on the history of geometry, even down to the prefatory sketches in our elementary works, that the subject will appear at its first enunciation to promise only "a resurrection-dish of stale condiments." Had it been my intention, however, to merely repeat the silly narratives of the Greek writers, I should have spared myself the trouble of writing, and your readers of scanning, a single line on the subject. It is rather my object to seek from internal evidence than from the unsatisfactory testimonies of historians, who knew nothing of the subject-matter of their statements, what was the real character of the progress of geometry from its first rude beginnings and subsequent development of the most perfect specimens of logical skill, that the world has ever seen.

I do not, however, propose to tie myself down to a close imitation of a systematically composed essay. Nor shall I often enter into any direct controversion of the specific writings of modern times. I put down my own views simply; and if I should be ever led to discuss the subject more minutely, it must be in another form and in a separate work. I shall be most glad, however, of any friendly suggestion, pointing out where a competent judge in such matters may think I am in error; and I have no doubt of the liberal Editor of this Magazine affording every facility for discussion, whilst conducted with courtesy and decorum.

The views explained in these Notes have been expressed verbally to many friends; and in deference to their opinion, which on all occasions are entitled to respect, I here venture to lay them before the public.

This discussion is offered with some degree of confidence, although with a full share of misgiving. As, from the nature of the subject, and the absence of all documentary evidence, it may be deemed to be entirely conjectural; yet the internal evidence furnished by the work itself, the principles upon which it is constructed, and the natural processes of the human mind in abstract research, will, I hope, be allowed to have some weight where other and better testimony is wanting. But, in truth, we have no trustworthy history of the ancient geometry. beyond what is furnished by the ancient treatises themselves, anterior to the notices left in the mathematical collections of Pappus; for surely no one will contend for the *jejune* gossip of Proclus, or still less the philosophers and historians of Greece of earlier or later days, furnishing trustworthy materials for mathematical history. A few broad remarks may be roughly true; but, at best, these only refer to eras, not to the detailed history and philosophy of science. Except evidence derived from the writings of a geometer can be adduced, we are in perhaps as favourable a position for the investigation as though a greater number of mere historians and philosophers had left works that had reached our own times. Perhaps such histories as are required might yet be found—possibly like one Greek author in a mummy-case, but far more likely in the form of Arabic translations in the archives of the Escurial and other Spanish palaces.

We must dismiss, *in limine*, the absurd inference so often quoted from Herodotus, respecting the destruction of the land on the banks of the Nile being the origin of all notice of geometrical figures. All that Herodotus states, however, is very probable, except his inference from it. The case simply amounts to this:—that the king-landlord sent his steward, on the representation of the tenant that so much land had been washed away, to "survey" the property and adjust the rent accordingly. Possibly also, where landmarks had been obliterated, to restore them *officially* from his own surveys, and prevent disputes between contiguous tenants. That this should be assumed by Herodotus as the origin of geometry is perhaps not wonderful; for he seems to have considered

* We are happy to announce that the "Geometry of the Line and Plane," which has so long stood over owing to the Author's indisposition, will be shortly resumed and completed. A few copies will be struck off for distribution amongst those of our readers who may desire to have the subject in a complete state, at the cost to which we are actually put; and those who desire to possess the work in that state are requested to send their names to the Editor.

as true every fable narrated by the Egyptian priesthood; and he was not very conversant with any science, but most especially deficient in all abstract research. He saw nothing in geometry but a practical art; and in that art itself, only a system of special and ingenious contrivances.

One would almost suppose that, from the universal adoption of this opinion of the origin of geometry, Christian writers repudiated the authority, authenticity, or antiquity of the Old Testament. Is it possible that Tubal-Cain, "a worker in brass and iron," should be ignorant of the simple forms and simpler properties of geometrical figures? Is it possible to conceive the builder of the ark, with these figures for one hundred and twenty years before his eyes, in his hands, and intently occupying his mind,—that Noah should not know the properties of a rectangle? Could the founders of the great tower on the plains of Shinar project and carry on such a building without some such knowledge—much greater than that spoken of by Herodotus? None know better than practical workmen the elementary properties of figures — whether in wood, stone, or metal, and especially those which relate to figures to be fitted together, for the accuracy of which they must have some kind of test, which is only another name for a geometrical property of the figures concerned. The logic or proof by which they arrived at this test is another question. In fact, without going to the Scriptures at all, the necessity for a somewhat extended knowledge of the properties of geometrical figures might have suggested themselves to the mind of the traveller, in contemplating the pyramids, the palaces of the kings, the temples of the priesthood, and even the very dwellings in his own country where his childhood had been spent. All these would have furnished instances of more advanced knowledge than the particular instance which he quotes.

Nor is there much probability in the story related by Diogenes, Laertius, and Plutarch, respecting the wonder of the Egyptian king, at the sagacity of Thales, in proposing to measure the altitude of the pyramids by means of their shadows. If it be true, then Amasis must have been an exceedingly simple and ignorant king; but his priests, at least, would be less surprised at the fact.

None but a race of savages can be wholly ignorant of some properties of the simpler geometrical figures — nor even they universally and absolutely. Civilization implies *arts;* and all arts imply more or less of *geometrical knowledge:* whilst the latter necessarily leads the more active and contemplative minds to an investigation (by experiment and induction, perhaps, in the outset) of more extended properties, and for evidence of some kind or other for those already known. The plane, the sphere, the cone, the prism, and the pyramid must become familiar subjects of thought, and their properties those of interesting and earnest inquiry; as well as the triangle, the rectangle, parallel lines, the circle; and ultimately, sameness of form and ratio of magnitudes. This may take place slowly, but take place it must.

The testimony of the Greek writers is uniform as to geometry being brought from Egypt into Greece; and no question can be raised on this head. The great question is, as to *what kind* of geometry it was — especially with what kind of evidence and modes of demonstration it was supported? In short, what was its state as a *science* upon its first importation?

Looking to Egypt alone, we find a race amongst whom the mechanical arts had been highly cultivated, and that upon a very gigantic scale. The consideration of equality as tested by two different objects fitting into the same matrix, or of two plane figures fitting one *upon* the other, could not but present itself at a much ruder and earlier stage of art than the Egyptians had attained in the time of Thales. However uncontemplative the national mind may be estimated, the contrary of this assumption cannot be maintained for a moment. Then the first, the greatest, the fundamental principle of geometrical demonstration, follows to have inevitably been known to the Egyptians—viz., *the application of one figure to another,* or to the matrix of another. The mind of an Egyptian "operative" which could stop short of this, is simply inconceivable.

But to render the device of *transposition of figures* available for demonstration, another and less obvious step was essential:—the assignment of the conditions that shall rende a figure determinate and invariable. For instance, to

see that the magnitude of a circle was fixed when its radius was given; that a parallelogram was given when two adjacent sides and the included angle were given; or that a triangle was given when either two adjacent sides and their included angle, or when the two adjacent angles and their included sides, were given.

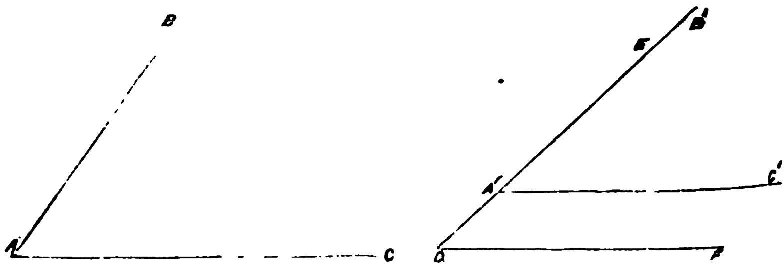
The most natural mode of conducting this inquiry was that of which many traces remain in the most perfect of the Greek writers themselves—in the "Elements of Euclid." It consisted in the comparison of two figures subjected to the same three conditions, by means of superposition. Few cases, probably, would occur in respect to simple figures more complex than the demonstration of i. 4, as left by Euclid and his commentators when all the steps of that demonstration are formally inserted.* Neither in the comparison of circles, and of lines in them as to equal, greater, or less, would even so much difficulty be encountered. Thus, some of the leading properties of triangles and circles (as well as of rectangles, discussed in Euclid's Second Book), could scarcely fail to become known to the Egyptians; and geometry *as a science*, though in a crude form enough, must be inferred to have been imported by the Greeks, and not invented by them. It only required elaboration through the wonderful Greek mind, to become what Euclid, Apollonius, and Archimedes left it.

But the principle does not terminate with superposition in plano, or with the corresponding operations in bodies of three dimensions. Under the general form of *transposition*, it was capable of giving legitimate proof of a large range of propositions; and of rendering the truth of others highly probable; whilst the inquiries that it was calculated to suggest were both numerous and important.

In its simplest form after actual supposition, we have it illustrated in Euc. i. 35, and some of the following theorems. This is Euclid's second test of equality. It consists simply in this: that if from the figure ABCF either the triangle ABE, or its equal DCF "be taken away," the remainders BCFE, ABCD, will be of the same magnitude. This is really nothing more than to apply to the particular case under consideration the axiom:—from whatever part of one figure another figure be removed, taken away, or transposed, the magnitude of the remainder is the same.

Another instance may be adduced in respect to *parallels*. Thus, let there be two equal angles, ABC, EDF; then, as is shown in the proof of i. 4, the lines AB, BC, may be made to coincide with ED, DF; and the coincidence will be entire through the whole distances to which the lines may be extended. Now the point A may be gradually transposed from D along the lines DE, so that in all the positions it can take, as A'B, it shall coincide with DE. But AC being transposed with AB to the corresponding position A'C', it *must wholly lose* its coincidence with DF at the initial stage of the motion of A from D. Now if we call A'C' in any one of its propositions, a parallel to DF, we state the same thing in other words, by precisely the language of Euclid's 35th Definition (*Simson's Euc.*).

Again it would follow from the equality of the angles EDF, A'B'C', combined with the second axiom and *i.* 13, that the two angles FDA', C'A'D are together equal to two right angles.



* In a future note this will be illustrated.

Whence would follow a justification, more or less satisfactory to different minds, of the fact enunciated in Euclid's 12th Axiom.

It is not intended to say for a moment that this method of investigation is rigidly accurate; but it is the kind of reasoning that would commend itself by its obviousness, to minds little tutored in such evidence, and in the absence of any general rules for logical inference. It is, moreover, a view so intimately connected with that to which Euclid at last found himself obliged to adhere, that we are almost compelled to admit that it was out of such materials Euclid did actually construct his theory of parallels. He has, however, met the difficulty by changing the order of the dependence of the facts, and by taking as an axiom a property more in accordance with the rigid rules that prevailed in the school of Plato. As an axiom, too, it must probably continue to be received, as long as geometry shall retain the slightest remnant of its present character.*

Certain properties of parallels and parallelograms would thus become known to such inquirers as we may suppose the Egyptians, especially the priesthood, to have been. This would lead to what will be here taken as the third and closing instance:—that of *similar* plane and solid figures.

In the examination of the cases of triangles, only two would be found, in which three conditions did not *absolutely fix* the triangles to be equal. The first when two sides and the angle opposite to one of them were equal respectively to two sides of the other, and to the angle opposite to one of them:† the second when the three angles of the one triangle were equal, each to each, to the three angles of the other.

Setting aside the former of these cases (as offering no difficulty beyond that of discrimination or enumeration, and the seeming departure under certain circumstances from a rule otherwise general), the great difficulty of extending the inquiry would arise from the latter. The result of the hypothesis now becomes sameness of form instead of the equality of the magnitudes of the sides, each to each. But sameness of form, though a conception easily induced, and indeed actually forced upon the mind, was not a conception easy to define by means of the conditions which were essential, and the exclusion of those which were superfluous, to a complete definition. Even as left by Euclid, the definitions of similar rectilinear figures and similar polyphidrons are erroneous: in both cases, by excess of conditions, and in the latter by a defect likewise. Great difficulties then stood in the way of earlier, and still greater in the way of the earliest speculators on the topic of similitude. All circles, probably, would be tacitly assumed as of the same form, and likewise all spheres: but if we were to conceive it possible that two parabolas or two cycloids had been encountered by these pioneers in scientific geometry, it is utterly improbable (indeed, all but impossible) that the notion of similitude with respect to them should have occurred to minds so little disciplined. On the other hand, the case of two triangles mutually equiangular, would be a matter of comparatively simple discussion; and the similitude of two polygons, determined by means of their component similar triangles, would readily follow.

Thus, let the three angles of the triangle ABC be respectively equal to those of DEF (that is, A to D, B to E, and C to F;) and let DEF be applied to BAC so that EF shall fall upon BC, and take the position BF′. Then, since the angle

* Several writers of late years have revived a fancy of former ages; that the difficulty would be got over by a different definition. Amongst these new definitions is that of A′C′, DF making equal angles with ED. These geometers encounter an equal difficulty to the ancient one, in attempting to prove that A′C′, DF *must then* make equal angles with *any other line that meets them*. Nothing is gained, but something of perspicuity is lost.

† This case is no where referred to by Euclid, although under certain restrictions the proposition would be true:—

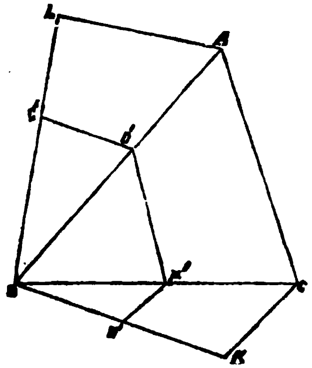
(1.) When the given angle is either right or obtuse.

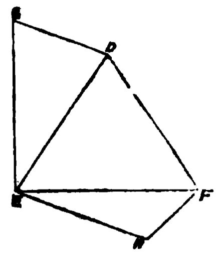
(2.) When the side opposite the given acute angle is greater than the other side.

(3.) When it is equal to a perpendicular upon the third side from the angle opposite to that side.

It is only when the third side is greater than the aforesaid perpendicular, less than the other given side, and has the given angle opposite to it acute, that the equality does not necessarily subsist. The corresponding case of similar triangles (somewhat awkwardly put, however,) forms *Euc.* vi. 7.

Neither is the other case (equiangular triangles) brought under notice till the Sixth Book. All restricted and failing cases are systematically passed over by Euclid till he is able to discuss them completely.





DEF is equal to ABC, the line DE will fall upon BA, and take the position BF′; and the position D′F′ then taken by DF becomes fixed and inevitable. In this case, then (omitting obvious and unnecessary details), the angle BF′D′ is equal to BCA, and BD′F′ to BAC; and for either of these reasons D′F′ is parallel to AC. One important point is thus made out respecting the connection between parallels and similar triangles; and this it is easy to see might (like its converse, which might have been obtained with equal ease) be made a cardinal property from which to deduce many others.

(To be continued.)

ACT TO EXTEND AND AMEND THE ACTS RELATING TO THE COPYRIGHT OF DESIGNS, 15th August, 1850, 13 and 14 Victoria.

Preamble Declares that it is expedient to extend and amend the Acts relating to the Copyright of Designs.

Clause 1. Enacts, that the Registrar of Designs, upon application by or on behalf of the proprietor of any design not previously published within the United Kingdom of Great Britain and Ireland, or elsewhere, and which may be registered under the Designs Act, 1842, or under the Designs Act, 1843, for the provisional registration of such design under this Act, and upon being furnished with such copy, drawing, print, or description in writing or in print *as in the judgment of the said registrar shall be sufficient to identify the particular design in respect of which such registration is desired*, and the name of the person claiming to be *proprietor*, together with his place of abode or business, or other place of address, or the style or title of the firm under which he may be trading, shall register such design in such manner and form as shall from time to time be prescribed or approved by the Board of Trade; and any design so registered shall be deemed "provisionally registered," and the registration thereof shall continue in force *for the term of one year from the time of the same being registered as aforesaid.*

Clause II. That the proprietor of any design which shall have been provisionally registered shall, during the continuance of such registration, have the sole right and property in such design; and that the penalties and provisions of the said Designs Act, 1842, for preventing the piracy of designs, shall extend to the acts, matters, and things next hereinafter enumerated, as fully as if those penalties and provisions had been re-enacted in this Act, and expressly extended to such acts, matters, and things respectively; that is to say:—

1. To the application of any provisionally registered design, or any fraudulent imitation thereof, to any article of manufacture or to any substance.
2. To the publication, sale, or exposure for sale of any article of manufacture or any substance to which any provisionally registered design shall have been applied.

Clause III. That during the continuance of such provisional registration neither such registration nor the exhibition or exposure of any design provisionally registered, or of any article to which any such design may have been or be intended to be applied, *in any place, whether public or private, in which articles are not sold, or exposed, or exhibited for sale, and to which the public are not admitted gratuitously*, or in any place which shall have been previously certified by the Board of Trade to be a place of public exhibition within the meaning of this Act, nor the publication of any account or

description of any provisionally registered design exhibited or exposed, or intended to be exhibited or exposed, in any such place of exhibition or exposure, in any catalogue, paper, newspaper, periodical, or otherwise, shall prevent the proprietor thereof from registering any such design under the said Designs Acts at any time during the continuance of the provisional registration, in the same manner and as fully and effectually as if no such registration, exhibition, exposure, or publication had been made; provided that every article to which any such design shall be applied, and which shall be exhibited or exposed, by or with the licence or consent of the proprietor of such design, shall have thereon or attached thereto the words "provisionally registered," with the date of registration.*

Clause IV. Provides that the sale of articles to which provisionally registered designs, &c., have been applied shall defeat copyright, but that the copyright of the design itself may be sold.

Clause V. That the Board of Trade may, by order in writing, with respect to any particular class of designs, or any particular design, extend the period for which any design may be *provisionally* registered under this Act for such term not exceeding the additional term of six months as to the said Board may seem fit.

Clause VI. That the registrar of Designs, upon application by or on behalf of the proprietor of any sculpture, model, copy, or cast within the protection of the Sculpture Copyright Acts, and upon being furnished with such copy, drawing, print, or description, in writing or in print, as in the judgment of the said registrar shall be sufficient to identify the particular sculpture, model, copy or cast in respect of which registration is desired, and the name of the person claiming to be proprietor, together with his place of abode or business, or other place of address, or the name, style, or title of the firm under which he may be trading, shall register such sculpture, model, copy, or cast in such manner and form as shall from time to time be prescribed or approved by the Board of Trade for the whole or any part of the term, during which copyright in such sculpture, model, copy, or cast may or shall exist under the Sculpture Copyright Acts.

[* This clause has obviously special reference to the Exhibition of 1851—in the interest of which, indeed, the entire Act is conceived; and one significant fact we gather from it is, that there is to be no *gratuitous* admission to that exhibition. If there be, then any article exhibited there, will lose any protection which it might have derived from "provisional registration" under this Act; the exhibition must be one to which the public are *not admitted gratuitously*.—Ed. M. M.]

Clause VII. That if any person shall, during the continuance of the copyright in any sculpture, model, copy, or cast which shall have been so registered as aforesaid, make, import, or cause to be made, imported, exposed for sale, or otherwise disposed of, any pirated copy or pirated cast of any such sculpture, model, copy, or cast, in such manner and under such circumstances as would entitle the proprietor to a special action on the case under the Sculpture Copyright Acts, the person so offending shall forfeit for every such offence a sum not less than £5 and not exceeding £30 to the proprietor of the sculpture, model, copy, or cast whereof the copyright shall have been infringed; and for the recovery of any such penalty the proprietor of the sculpture, model, copy, or cast which shall have been so pirated shall have and be entitled to the same remedies as are provided for the recovery of penalties incurred under the Designs Act, 1842.

Clause VIII. That designs for the ornamenting of ivory, bone, papier maché, and other solid substances not already comprised in the classes numbered 1, 2, or 3, in the Designs Act, 1842, shall be deemed and taken to be comprised within the class numbered 4 in that Act, and such designs shall be so registered accordingly.

Clause IX. That the Board of Trade may from time to time order that the copyright of any class of designs, or any particular design registered, or which may be registered under the Designs Act, 1842, may be extended for such term, not exceeding the additional term of three years, as the said Board may think fit, and the said Board shall have power to revoke or alter any such order as may from time to time appear necessary. [A very important and useful provision.]

Clause X. That regulations for the registration of designs may be made by Board of Trade.

Clause XI. That registrar of designs may dispense with drawings, &c., in certain cases.

Clause XII. That public books in the Designs'-office are not to be removed without judges' order.

Clause XIII. That judges may order copies of documents to be furnished to be given in evidence.

Clause XIV. That copies of documents delivered by the registrar are to be sealed and to be evidence.

Clause XV. That the several provisions contained in the said Designs Acts, so far as they are not repugnant to the provisions of this Act, shall apply to the registrations under this Act, as fully and effectually as if those provisions had been re-enacted.

PATENT LAW CASE.

NISI PRIUS COURT, LIVERPOOL, AUG. 20.

(*Before Mr. Justice* CRESSWELL *and a Special Jury.*)

HOWARD AND ANOTHER *v.* PEACOCK.

This was an action brought for the infringement of a patent for weaving silk plush in a particular manner, described as "floating the pile warp over more than five picks."

The plaintiffs are silk plush manufacturers in the neighbourhood of Manchester, and took out a patent for an alleged improvement in the manufacture of silk plush for carrying the pile over more than five threads, thus enabling the pattern to be varied, fixing the pile more strongly, and manufacturing more economically. The defendant having manufactured some goods of the same kind, the plaintiffs brought their action against him for infringing their patent. The defendant called a number of witnesses who proved that the mode of manufacturing silk plush by carrying the pile warp over more than five "picks" was known and used as long ago as 1807, and before that period, and specimens were produced then woven. Evidence was called in reply, the effect of which was, that in the specimens produced, the "pile" was only "floated over four picks."

His LORDSHIP having summed up the evidence,

The Jury found a verdict for the defendant.

Counsel for the plaintiffs, Mr. Martin, Q.C., Mr. Atherton, and Mr. Webster; and for the defendant, Mr. Hoggins, Q.C., and Mr. Cowling.

VISCOUNT DE SERIONNE'S IMPROVEMENTS IN THE MANUFACTURE OF BUTTONS.

This invention consists in the manufacture of buttons, knobs, or other similar articles, which have hitherto been made from porcelain or China clay, from crystallized felspar, common felspar, basalt, lava, pumice-stone, granite, sand, and free-stone silex.

The buttons are divided into two classes; "straz," which are transparent, and "agathe" (query, "agate"), which are opaque.

The straz buttons are manufactured from pebbles, of crystallized felspar, which contain as little clay and lime, or lime salts, as possible. These pebbles are reduced to powder by heating them to the degree of temperature known as "rouge cerise" (cherry red), and then plunging them into cold water. The powder is separated from its impurities by being passed through a wire gauze sieve, and is next well stirred in water. The supernatant water is decanted off, and carries with it the clay which was held in suspension, while the residuum is treated with a quantity of hydrochloric acid, varying from 3 to 10 per cent., to free it from the oxide of iron, which would give the buttons a reddish tinge in the baking process, and from the lime or its salts, which would render them more or less opaque. The powder is subsequently washed with water, to free it from acid, until it resists the test of litmus paper, when it is dried. 100 lbs. of the powder is then mixed with 2 lbs. chloride of sodium and 4 lbs. flour paste, dissolved in 5 quarts of water, and the large particles ground small by a wooden roller. This mixture is passed through a sieve, and granulated in the same way as gunpowder, and dried to a proper consistency for moulding.

The agate buttons are made from natural felspar, partly decomposed, but not in the state of "kaolin." It is treated much in the same manner as the crystallized felspar, except that it is mixed with a sufficient quantity of lime, or any of its salts, which are not injuriously affected by heat; such as phosphate, superphosphate, or any of the sulphates, to give it the necessary degree of opacity.

Instead of sodium, the patentee states that barium or strontium may be used; and that any of the quartzeous sands may be employed instead of felspar.

The moulding-machine consists of a screw press, fitted with levers and other mechanical contrivances. It contains an upper and lower matrix, and intermediate perforated plate, which is charged with the prepared materials. The matrices are then brought together, with the perforated plate between them, and the buttons thereby compressed. The sockets for the shanks, or the holes for sewing the buttons on, are formed by removing the inferior matrix, and lowering the perforated plate on to a number of projecting pieces. An iron frame, supporting a sheet of paper, is then introduced under the perforated plate, and the buttons deposited thereon by depressing the upper matrix, so as to force them through the holes in the intermediate plate. The sheet of paper with the buttons on it, in the same order which they occupied while in the mould, is then placed on a red-hot earthenware plate, which burns the paper, and retains the buttons. These plates, with the buttons on them, are then placed in a like number of elliptically-shaped muffles, which are arranged in such manner inside an oven as to allow the products of combustion to play around them, and impart an equal quantity of heat on each side.

To fix the shanks in the sockets, the patentee employs one of the following vitrifi able cemnts:

1. Fritted agate substance	100 parts	very hard.
Crystal	50 ,,	
2. Fritted agate substance............	90 parts	fusible.
Crystal	15 ,,	
3. Fritted agate substance............	60 parts	very fusible.
Calcined at 25 per cent. of pewter..	60 ,,	
Crystal	10 ,,	

It is proposed to ornament the buttons by first covering them with a mordant, such as linseed oil, &c., and then dipping them in a powder of any of the suitable metallic oxides; after which they are to be baked: or, by coating them with an enamel composed of 300 parts crystallized felspar, as free as possible from iron; 400 parts minium, as pure as can be obtained; 200 parts pure calcined nitre, and 100 parts borax. This compound is mixed with any of the suitable metallic oxides, in the necessary proportions, according to the colour required to be given.

The patentee describes, lastly, a mode of ornamenting flat surfaces of glass or other similar substance, by employing "poncis" (we presume stencil-plates); through the open parts of which he deposits the colour on the glass (previously coated with gum), and fixes it by means of steam.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING AUGUST 22ND, 1850.

WILLIAM CORMACK, of King-street, Dunston-road, Haggerstone, Middlesex, chemist. *For improvements in purifying gas, also applicable to obtaining certain products or materials from gas-water and other similar fluids.* Patent dated February 21, 1850.

The object of this patent is to free coal gas from ammonia, sulphur, and sulphuretted hydrogen, and to recover these products.

To effect this, the patentee employs any metallic salt (not a chloride), the base of which is capable of being precipitated by the sulphuretted hydrogen as a metallic sulphuret, and any of the salts called muriates, which, in combination with the acid of the metallic salt, carries off the ammonia in the form of an ammoniacal salt. Protosulphate of iron, otherwise called green copperas, and common salt are the most economical substances, and are to be employed as follows:—To 150 gallons of water add 140 lbs. green copperas and 74 lbs. common salt. This mixture is poured into a receiver, through which the gas is made to pass. After the substances in solution are exhausted or decomposed by the gas that has passed through them (which may be ascertained by the ordinary tests of acetate of lead and litmus paper), the liquor is to be withdrawn, and a fresh quantity supplied. The results of this purification are sal-ammoniac and sulphate of soda (which remain in solution in the water), and an insoluble matter, supposed to be sulphuret of iron, which is precipitated after the liquor has settled.

The sal-ammoniac and sulphate of soda may be separated in the ordinary manner by crystallization and evaporation.

For dry purification the patentee employs like quantities of copperas and salt as above, which are to be mixed with 2½ bushels of animal or vegetable charcoal, and about 12 or 15 gallons of water, to reduce the whole to a pulpy consistency, and the purification is effected as in the ordinary method of dry-lime purification. From this process the same products as above will be obtained, which are to be separated from the charcoal by the methods ordinarily in use. Or flock may be kept saturated with the first-named mixture, and spread on sieves, through which the gas may be made to pass, and with the same results as before mentioned.

Should other metallic salts or muriates be employed, the quantities thereof must be chemically equivalent to the before-mentioned proportions for copperas and salt, but although sal-ammoniac will still be obtained, the other results will differ according to the nature of the substances employed.

The process of separating the ammonia and sulphuretted hydrogen from the gas water and other fluids containing the same, is similar in principle to the operation above described, sal-ammoniac and other matters varying with the substances employed, being obtained.

Claims.—1. The combination and application of the matters above named to the purification of gas, and the obtaining products therefrom.

2. Obtaining products from gas water and other similar fluids, as above described.

JOHN SLACK, of Manchester, Lancaster, manager. *For certain improvements in the manufacture of textile goods or fabrics, and in certain machinery or apparatus connected therewith.* Patent dated February 21, 1850.

The improvements relate to stiffening or

dressing goods while being manufactured in the loom. A trough containing "gum," or "gum substitute," is placed at some part of the loom between that at which the cloth is formed and the beam upon which it is wound. The gum is applied to the lower surface of the fabric by means of a distributing roller, which derives its supply from another roller immersed in the trough. Both rollers are put in motion by the loom, so that their velocity accords with the rate of the weaving of the fabric.

THOMAS WHIFFEN, of Pig's Quay, Bridewell Precinct, accountant. *For improvements in machinery for registering the delivery of goods.* Patent dated February 21, 1850.

These improvements consist in the application of an instrument composed of a ratchet and ratchet-wheel, together with suitable toothed wheels and a dial-plate, to the trap-door of ships' coal-weighing machines, so that the number of times the door of the shoot is opened for the discharge of coals may be registered. The patentee proposes the application of a similar instrument for registering the filling of measures of grain, and for indicating the number of times porters or carriers pass along a plank with goods. No drawings or claims are given.

CHARLES ANDREW, of Compstall-bridge, Chester, manufacturer, and RICHARD MARKLAND, of the same place, manager. *For certain improvements in the method of and in the machinery or apparatus for preparing warps for weaving.* Patent dated February 21, 1850.

The patentee employs a beam for winding the warps, with very deep flanges, composed of two rings, so that when the warp upon the beam is reduced to the size of the smaller ring, the larger one is taken off to prevent vibration of the machine. From the beam the warp is conveyed through a reed, and through the trough containing the dressing, over a revolving brush, through a colour trough, and on to a revolving reel with hollow arms, into which steam is allowed to circulate freely. A hollow case, also heated by steam, is placed on the lower side of the reel. The heat thus obtained, assisted by the action of a fan revolving rapidly within the reel, is sufficient to dry the dressed warp, which is then carried out to the weaver's warp beam.

Claim.—The arrangement by which two separate beams, with warps of different numbers of reeds, may be warped by the same machinery and at the same time, especially the double flanges; and also the means for drying the warp.

WILLIAM MAYO, of the firm of Mayo and Warmington, of Silver-street, Wood-street, Cheapside, manufacturer. *For improvements in connecting tubes, and pipes, and other surfaces of glass and earthenware, and in connecting other matters with glass and earthenware.* Patent dated February 21, 1850.

In connecting pipes and tubes of glass and earthenware, the patentee proposes to have metal flanges cast on the ends of the tubes to be united, which are connected by ordinary screw couplings. The interior of the mould being of the desired shape for casting the flange, the end of the tube, previously heated, is inserted, and sustained in a vertical position by means of a collar fitted to the upper part of the mould. Sufficient metal to fill the interior of the mould is then poured through an opening, and the tube is withdrawn as soon as the metal is set. An adjustable screw, in the form of a plug, fits into the tube, and forms the bottom of the mould, thus preventing the metal from rising inside the tube.

The patentee does not claim exclusively the casting of metal on to glass or earthenware;—collars for earthen bottles for containing aërated waters having been previously employed, but he claims:—The casting of metal joints on tubes or pipes of earthenware, to connect such tubes, or for the connection of such tubes to plates or surfaces of glass and earthenware, or for connecting to each other such plates or surfaces of glass and earthenware.

ALFRED VINCENT NEWTON, of Chancery-lane, Middlesex. *For improvements in separating and assorting solid materials or substances of different specific gravities.* (A communication.) Patent dated February 21, 1850.

These improvements relate generally to the separation of substances of different specific gravities, but are exemplified in the specification and drawings as applied to the separation of copper ore from other substances with which it is generally found combined. The ore is first crushed and brought to a granular state by being passed successively between several pairs of rollers, each pair in the succession working closer together than those preceding. The pulverized substances are then passed through revolving sieves, so that the mass may be separated into portions of which the separate pieces shall be as near as possible of one size. Blocks of India rubber are placed in the sieves, which produce a series of soft blows by the movement of the sieves, and keep the meshes from becoming clogged. The materials thus separated are then subjected, while falling, to the action of a blast produced by a fan, which causes the lighter portions to be blown further along the floor of a chamber in which are a series of bins for their reception. The blast is made to

pass through screens previous to its coming in contact with the falling substances, by which the current is equalized.

Claims.—1. The employment of blocks of India rubber, or other equivalent substance, for preventing the meshes of the sieve from becoming clogged.

2. Placing screens between the blower and the falling materials, for the purpose of producing an equal diffusion of the blast.

JOHN SCOFFERN, of Essex-street, Middlesex, M.B. *For improvements in the manufacture and refining of sugars, and in the treatment and use of matters obtained in such manufacture, and in the construction of valves used in such and other manufactures.* Patent dated February 21, 1850.

The first part of this invention has reference to a former patent for employing sub-acetate of lead in the defecation of cane juice, and is thus described:—

Heat the juice in a suitable iron or copper vessel to about 212° Fahr., and take off the scum which rises; continue the operation till the density of the boiling matter shall have increased 1° by Beaumé's saccharometer. Now remove the source of heat, allow the saccharine matter to cool to about 1° below boiling point, and add the sub-acetate of lead in the proportion of one-sixth per cent., reduced to a paste by the addition of water.

The second part refers to a new pigment which is prepared from sulphite of lead precipitated during the boiling of sugar, as above, by the addition of sulphurous acid. This pigment is white, and may be employed in lieu of white lead, as it gives a good body to paint, and "covers" well. It may be also prepared from any liquid containing sub-acetate of lead.

Thirdly, the patentee describes a new valve peculiarly adapted to the supply of sulphurous acid to sugar in refining, or liquids requiring to pass one way only. It consists of a tube, the bottom of which is closed, and the sides near the bottom perforated. Outside is fixed a band of vulcanised India rubber, the elasticity of which permits liquids or air to be forced through the perforations, but by contracting as soon as the pressure from within is removed, effectually prevents their return.

Claims.—1. The employment of sub-acetate of lead in the defecation of cane juice, as above described.

2. The manufacture of sulphite of lead as a pigment in the manner above described.

3. The peculiar construction of valve above described.

ALEXANDER HEDLARD, of Paris, France, gentleman. *For certain improvements in propelling.* Patent dated February 21, 1850.

One improvement is thus stated:—Two cylinders (open at their outer ends) and pistons are placed in a horizontal position at the bottom of a vessel, which is to be propelled by the pistons ejecting water form the cylinders against the external water. The other improvements will be gathered from the claims, which are:—

1. The application of pistons and cylinders for the propelling of vessels, atmospheric air being allowed to act freely on the back of the pistons.

2. The air-chamber at the back of the pistons for preventing the water from getting into the interior of the vessel.

3. The inclined shoot for causing the vessel, when required, to move astern.

4. The flap for closing the cylinders. And,

5. The arrangement of double keels (with the two cylinders between them).

GEORGE HOLWORTHY PALMER, of Westbourn Villas, Harrow-road, Middlesex, civil engineer; and JOSHUA HORTON, of Ætna steam engine boiler and gasometer manufactory, Smethwick, near Birmingham. *For improvements in the arrangement and construction of gas holders.* Patent dated February 20, 1850.

The object of this patent is to dispense with the present cumbrous and expensive mode of sustaining the tops of gas holders, by means of braces, trusses, girders, &c.

The top is made horizontal, and consists of an interior curb or circular support, formed of two parts of strong double 4-inch iron, bolted together, in addition to the outer curb at present in use. From the centre plate to the circumference, which is formed of four-gauge iron, there extend radial plates or arms of the same thickness, and varying in number with the size of the holder (say for a holder 100 feet in diameter, twelve radial plates), the intermediate spaces being covered with plate iron of twelve gauge, firmly bolted to the inner double and outer single curbs, and to an equilibrium block of teak placed between them. When the holder is afloat, the top will be raised by the pressure of the gas contained in the holder, and will thus prevent the strain thereby produced from falling too much on the outer curbs. To retain and discharge the rain which might effect a lodgement when the holder is not in use and the top deflected, a self-acting hydraulic cup is fitted to the centre of the top. Or, to obviate this deflection altogether, a wooden framework may be raised inside, on which the top may rest when the holder is not in use. By not riveting the side plates of the receiver to the lateral supports, the downward strain of the top and lateral supports on the side is thrown on to the foot curb. Corresponding to each arm in the top, a plate of metal of four gauge is fixed in the side casing, and

the intermediate space filled in with No. 10 gauge. To these thicker plates are attached the supports for pulleys, &c., which are employed as in the ordinary description of gas holder.

Claims.—1. The employment of the inner double curb and equilibrium blocks, as above described.

2. The arrangement before described, whereby the strain on the side of the holder is thrown on to the foot curbs.

3. The combination and application of these arrangements, as a whole, but not as regards each individual part, some of them having been previously adopted.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Aug. 15	2408	Thomas Moore Sharp	Donegal-street, Belfast	Sack elevator.
16	2409	Joseph Salt	Uxbridge-common	Pipe-socket die.
19	2410	Michael Neville	Liverpool	Joint for fastening and attaching pipes.
„	2411	Thomas Busby	Baths and Washouses, New-road	Valve apparatus for baths.
„	2412	Henry Fletcher	Manchester	Drawing roller.
„	2413	Thomas Brookes	Spital-square, Norton Folgate	The Sutherland silk.
20	2414	Lewis Lee	Woodbury, near Exeter	Cultivating plough.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Charles Heard Wild, of St. Martin's-lane, Middlesex, civil engineer, for improvements in certain structures for retaining water. August 17; six months.

Henry Holland, of Birmingham, umbrella furniture manufacturer, for improvements in the manufacture of umbrellas and parasols. August 22; six months.

Edmé Augustin Chameroy, of Paris, for improvements in paving streets and other surfaces. August 22; six months.

Frederick Hale Thomson, of Berner's-street, Middlesex, gentleman, and Thomas Robert Mellish, of Portland-street, same county, glass-cutter, for improvements in cutting, staining, silvering, and fixing articles of glass. August 22; six months.

William Dick, of Edinburgh, professor of veterinary medicine, Veterinary College, Edinburgh, for improvements in the manufacture of steel and gas. August 22; six months.

Benjamin Rotch, of Lowlands, Middlesex, Esq., for a factitious saltpetre, and a mode by which factitious saltpetre may be obtained for commercial purposes. August 22; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in refining gold. (Being a communication.) August 22; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the construction of ships' magazines. (Being a communication.) August 22; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in machinery or apparatus for producing ice, and for general refrigerating purposes. (Being a communication.) August 22; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the construction of ships or vessels, and in steam boilers or generators. (Being a communication.) August 22; six months.

Daniel Illingworth, of Bradford, Yorkshire, worsted spinner, for certain improvements in machinery for preparing all description of wool and hair grown upon animals, for the carding, combing, and other manufacturing processes. August 22; six months.

Duncan Bruce, of Paspebiac, Gaspe, Canada, but at present at Liverpool, Lancaster, esquire, for certain improvements in the construction of rotary engines. August 22; six months.

Richard Prosser, of Birmingham, civil engineer, for improvements in supplying steam boilers with water, and in clearing out the tubes of steam boilers. August 22; six months.

CONTENTS OF THIS NUMBER.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1412.] SATURDAY, AUGUST 31, 1850. [Price 3d., Stamped, 4d.
Edited by J. C. Robertson, 166, Fleet-street.

SLATE'S HIGH VELOCITY BLOWING ENGINE.

Fig. 1.

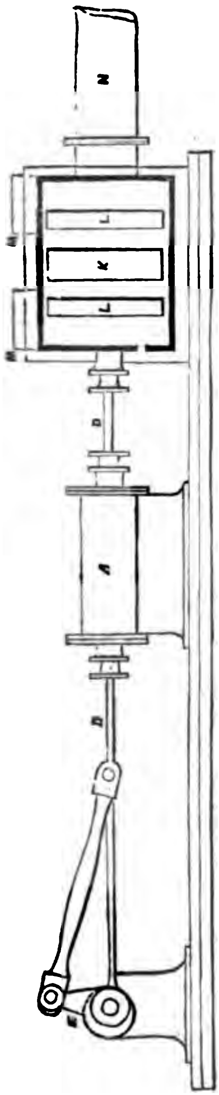
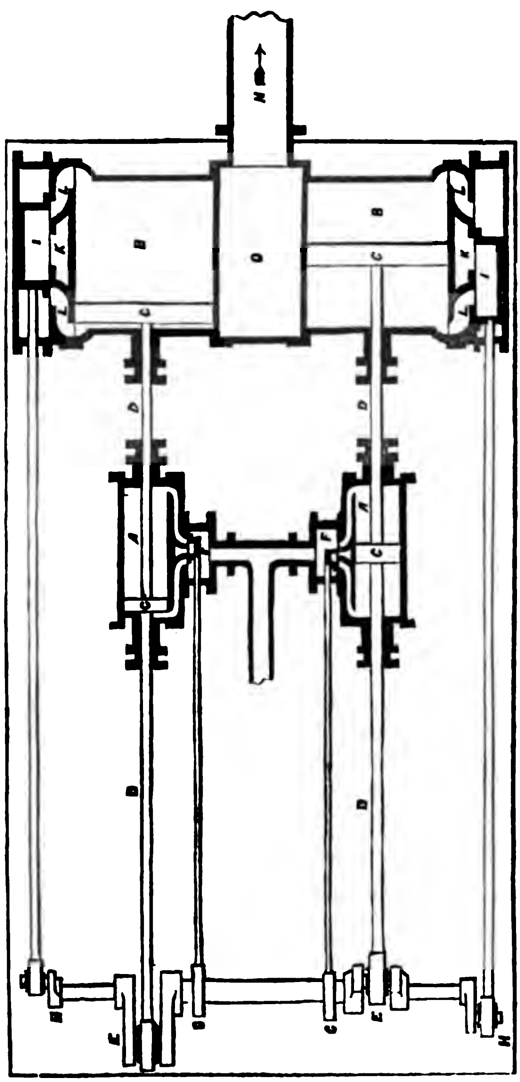


Fig. 2.



HISTORICAL SKETCH OF BLOWING ENGINES AND DESCRIPTION OF ONE FOR WORKING AT HIGH VELOCITIES. BY MR. ARCHIBALD SLATE, OF DUDLEY.

[From Proceedings of the Institution of Mechanical Engineers, July, 1850.]

In introducing a proposal for working blowing engines at high velocities the writer of the present paper wishes shortly to direct attention to the various changes through which this description of engine has passed, the better to elucidate the difficulties to be overcome, and the advantages to be derived from the further change now proposed.

The first records he has been able to collect show the blowing cylinders to be single-acting, or having the power of propelling the blast when the piston was moving in one direction only; three or more of these blowing cylinders appear to have been attached to one crank-shaft, worked by a water wheel, and thus a tolerably steady pressure of air has been obtained. When the gradual improvements of the steam engine and the demand for increased means of manufacture caused it almost entirely to supersede all other power, the blowing apparatus appears to have been accommodated as much as possible to the steam engine, so as to afford the character of engine for the time being the fullest development of its power.

In pursuance of this object the single-acting atmospheric engine of Newcomen was attached to a blowing cylinder, which propelled the air from the upper side of the piston only and in addition to the water regulator, which appears to have been known at an earlier date there was attached a cylinder now known as the regulating tub, which was equal to or larger in diameter than the blowing cylinder. In this was fitted a piston with a rod moving in a guide fixed on the open top of the regulating tub, the bottom of the latter being close, and having an open connection to the main from the blowing cylinder. The piston in the tub was loaded to the pressure of blast required, and in the intervals between the discharges of the blowing cylinder, the descent of the piston in the tub kept up the discharge of air into the water regulator, which intervened between it and the furnace; thus in effect, as far as possible, making the engine double-acting. To prevent the piston being blown out of the regulating tub, a large safety-valve was attached to the top of the rod by a strap, long enough to allow the desired play of the piston, and short enough to lift the safety-valve, or snorter, as it is usually termed, if the piston at any time exceeded its limits; and the number of strokes of the engine was also regulated by the tub piston, as to it the cataracts were attached.

When the double-acting engines of Watt were introduced, the regulating tub was still retained though not nearly so essential a part of the machine as in the former instance.

The next change that took place was the general abandonment of the water regulator (though some of these are still at work, or have been within a few years); the reason of this change was the discovery that the air in summer, already surcharged with moisture, took up an additional quantity from passing over the surface of the water in the regulator, and that this was prejudicial to the working of the furnaces.

When the large area of the water regulator was shut off, it was then found that the tub was by no means such a perfect regulator as it was supposed to be, as the momentum of the engine passed too suddenly into the heavy piston of the tub, and throwing it up much beyond the height due to the pressure of the air, caused an irregularity that was even more aggravated by its descent; to counteract this, a spring beam was placed on the top of the tub so as gradually to check the momentum of the piston, and this had some effect, but not at all a satisfactory one.

The next alteration which appears to have suggested itself, was the application of large air chambers, from twelve times to thirty times the area of the blowing cylinder, in which the elasticity of the compressed air acted as the regulator of the discharge, the tub with its piston being in some cases retained to work the cataracts, and as a telltale against the engine men, in case of their allowing the steam to slacken and the piston to descend. In other cases the tub was dispensed with altogether.

We now enter upon the last change which took place some fifteen years ago, namely, the coupling of two double-acting engines, and double-acting blowing cylinders upon the same crank shaft at right angles, so as to keep up a regular discharge. This effect was in some measure obtained, but an air chamber, or what is equivalent to it, very large mains, were still required to obtain what was considered a satisfactory result.

At this point the realized improvements of the blowing engine stop short, leaving it still a large cumbrous and expensive machine, and not capable of moving through its valves the *highly elastic medium air*, at a greater rate than the absolutely *non-elastic fluid water*, is moved through an ordinary pump. Under these circumstances, it must be obvious that

after all the engineering talent that has been spent on this description of engine, there is still (if the expression may be applied) a wide range of discovery open.

The immediate cause of the writer's attention being attracted to the improvement of the blowing engine, was the difficulty experienced in regulating one of the old construction of blowing engine in the latter part of 1848, and having at the same time occasion to employ some small 9-inch cylinders driven by the air of the large blowing engine. These small cylinders when driving the shafting only, sometimes attained a velocity of upwards of 200 revolutions per minute, suggesting the idea of the possibility of reversing their motion and taking in the air in place of blowing it out through them; there was however a difficulty in the slide valve which did not open and shut fast enough. After some consideration it was agreed that another cylinder should be prepared, and the centre port made much larger, and the slide overtravelled nearly half its stroke in excess, which had the desired effect; a cylinder of 9 inches diameter, and 1 foot stroke, having been driven 320 revolutions or 640 feet per minute, discharging the air at a pressure of $8\frac{1}{2}$ lbs. per squre inch, through a tuyere of 1-inch in diameter, or $\frac{1}{81}$th of the area of the blowing piston. This performance, as is well known, is more than double that of any ordinary engine, the total area of the tuyeres with a 90-inch blowing cylinder, being at a pressure of $3\frac{1}{2}$ lbs., about 52 circular inches, or $\frac{1}{124}$th of the area blowing piston.

We are all acquainted with tremour which is felt even in the best form of the large-sized engines; but in the experiments at a high velocity with the small-sized cylinders, not the slightest jar was felt or noise heard, it is therefore proposed to increase the speed of the piston in actual practice, from 640 to 750 feet per minute, the length of stroke being 2 feet in place of 1 foot, this is somewhat under the speed of a locomotive piston at 40 miles per hour, which is about 800 feet per minute, so that it is conceived no difficulty can present itself to this. The proposed speed of 750 feet per minute, is three times the usual speed of the present blowing engines, 250 feet per minute.

The construction of the proposed engine is shown in the accompanying figures; fig. 1 is a plan, and fig. 2, an elevation of the engine, showing the pair of steam cylinders and blowing cylinders; AA are the steam cylinders, 10 inches diameter and 2 feet stroke; BB the blowing cylinders, 30 inches diameter, and 2 feet stroke, with their pistons C, fixed on the same piston rods D, which are connected to two cranks E, fixed at right angles to each other on the same shaft. The slide valves F of the steam cylinders are worked by the eccentrics G on the crank shaft, and the cranks H at the other ends of the same shaft, work the slide valves I of the blowing cylinders. The centre port K, passes downwards to an external opening for the admission of the air, and the discharge ports LL deliver into the passages M, on the top of the cylinder, which communicate with the air main N, by the chest O, formed between the cylinders. The piston of the blowing cylinder is intended to be made without any packing, being a light hollow cast-iron piston turned to an easy fit; and the slide valve of the blowing cylinder to have a packing plate at the back, working against the cover of the valve box, with a ring of India-rubber inserted between this plate and the back of the valve, to give a little elasticity.

It appears that 30 inches diameter is somewhere about the most convenient size for a stroke of 2 feet, and as it is considered an advantage to have the stroke as short as possible, to increase the regularity of the blast, the comparative cost of the different engines which follows has been taken upon this basis $\frac{8}{10}$th inch steam cylinders and $\frac{8}{30}$th inch blowing cylinders, costing together (exclusive of the boilers) about 400*l.*, being reckoned equal to blow one of our largest furnaces, making 160 tons of iron per week, and having a surplus equal to blowing a cupola or refinery, as is generally allowed, as such an engine would give at 640 feet per minute the same speed of piston as in the experiments, very nearly 30 circular inches of tuyere, at a pressure of $3\frac{1}{2}$ lbs. to the square inch; the circular inch is used in speaking of the area of tuyere, as the blast that any furnace is taking is usually reckoned by simply squaring the diameter of the tuyere, but the pressure is taken on the square inch.

The experiments on which these calculations were founded, having been made upwards of twelve months ago, were repeated recently, and the results were found to be as nearly as they could be measured the same, the blowing cylinder had in the interval been driving the lathes in the pattern shop, and the slide was found perfect. An indicator was applied with a view to test the amount of friction of the air in entering the cylinder at the high velocity, and a simple method was adopted of ascertaining this. A tuyere was made as large as the inlet port, and the engine was driven to nearly or quite 700 feet per minute, when the gauge showed a pressure of one-fourth of a pound per square inch, and as the friction would be the same through the same sized openings at other pressures, it follows that the loss by friction on a pressure of blast of $3\frac{1}{2}$ lbs. per inch, would be one-fifteenth or $6\frac{2}{3}$ per cent loss; as the port in this case was one-eleventh of the area, and the port

posed is one-eighth, it is assumed that the loss would not exceed 5 per cent. from this cause, or indeed from any other cause, as the friction from propelling the air through a given sized tuyere, at a given pressure, must be the same in both cases.

Following up the comparison of first cost, we find that (exclusive of boilers, which are assumed the same in both cases but taking into account the cost of the engine-house), there would be a saving by the proposed plan of between 65 and 70 per cent.; the cost of a pair of the best engines in Staffordshire, blowing three furnaces, being 3,650*l*., while on the proposed plan they would cost 1,100*l*. if high pressure only, or if high pressure and condensing 1,350*l*., including in each case the engine-house, but not the boilers.

Many will prefer high pressure only, on account of its simplicity, but as it appears evident that a given quantity of steam can be condensed in the same time, in the same condenser, whether admitted in a few large jets or in a great number of small jets, there is no reason whatever why a condensing apparatus may not be attached to the short-stroke engine at high velocities; the only condition being that it must be equivalent to the power of the engine without relation to the size of the cylinder. The air-pump in this case must be double-acting with slide valves, or it may be rotary and placed round the crank-shaft, and there appears to be no advantage in a fly-wheel for such an arrangement of blowing engines.

The speed of the engine should be regulated by a hydrostatic governor, communicating with the blast main, and attached to the throttle valve, exactly similar to those used in gas works for regulating the engine driving the exhausters; this would regulate the engine with greater delicacy, and maintain a more uniform blast than can be done with the present engines; and the rapid succession of the strokes of the two small blowing cylinders acting alternately, would render the present large reservoir quite unnecessary.

Supposing the advantages claimed for this description of engine to be realised, which the writer has no reason to doubt, it may be applied to assist the present blowing engines where they are overpowered, which is in many instances the case, as there is no ready means of increasing their power as the works develope themselves, and greater calls are made on the engine; but in the case of the proposed engines, if at any time an increase were desired another blowing cylinder might be added to the shaft, at a comparatively small cost.

Referring again to what first drew the attention of the writer to this subject, the employment of small cylinders worked by the pressure of air, where it was inconvenient or impracticable to employ shafting; it has been found that a 12-inch air-cylinder with 3 lbs. pressure attached to a large foundry crane, under which 15·30 inch pipes are cast vertically every ten hours, does the work of double the number of men that could by any possibility work at the crane.

This suggests the possibility of a very considerable advantage to railway companies, by the use of the proposed engines, as the blowing cylinders for compressing the air might be attached to the end of the piston-rod of any of the small-sized engines now laid up at several stations, and the air conveyed to the various cranes, to which cylinders might be attached for about 25*l*. per crane, without disturbing the present arrangement for the use of manual power in cases of emergency. The saving of manual labour by such an arrangement will be best estimated by the managers of goods departments, some of whom are amongst the members, and with reference to the mechanical application of the power, the writer hopes to have the pleasure of presenting the Institution with another paper at some future meeting.

DR. NORMANDY'S TEST BOOK.*

The present book has its origin in a very sad state of things. The arts—of "Adulteration and Sophistication"—"have invaded the luxuries and necessities of both the rich and the poor; raiment, food, medicine, furniture,—the means of life and the requirements of disease,—all that can be mixed, heckled, twisted, ground, pulverized, woven, pressed,—all articles of consumption in trade, in manufactures, in the arts,—in a word, all that can be made matter of commerce, and sold, is *adulterated, falsified, disguised, or drugged*."—(Pref. i.) With some people, the only sure remedy for these

"* The Commercial Hand Book of Chemical Analysis; or, Practical Instructions for the Determination of the Intrinsic or Commercial Value of Substances used in Manufactures or Trades, and in the Arts. By A. Normandy, Author of 'Practical Introduction to Rose's Chemistry,' &c. 640 pp. 12mo. Knight and Sons, Foster-lane, London, 1850."

undeniable evils is, the establishment of a strict medical police—such as exists (though with but indifferent success) in some despotic states; but with others—including amongst them the learned author of the book before us, and, probably, every sound-thinking person—the best remedy of all is the diffusion of a knowledge of the means of distinguishing what is genuine from what is sophisticated.

"It is certain that if sophistication could be more readily detected, its practice would become less frequent, and be reduced in proportion to the increased chance of discovery; that is to say, it would diminish gradually as the knowledge of the means of ascertaining the commercial value of the goods offered for sale would become more diffused."—(Pref. vi.) But as no one can be expected to become conversant with every article of commerce, or to carry in his head a knowledge of the secrets of all trades, what is, and has been long wanted, is some source of ready reference, for the means of verification, when doubts of the genuineness of an article arise. As people refer to a Ready-Reckoner to check a calculation in arithmetic, or to a verbal dictionary to resolve a doubt in orthography, so should they have a test-book continually at hand, by turning to which they might ascertain on an instant the goodness of every article supplied to them. Were such a work but as common as a Cocker or a Johnson in households, it would do more than whole legions of medical police-inspectors to make manufacturers and dealers honest. Accum aimed at furnishing something of the sort in his well-known "Death in the Pot" (a work, by the way, which Dr. Normandy has strangely overlooked, or, at least, omitted to mention;) but it was so palpably got up to excite alarm, and to minister to popular prejudices, —so loose and reckless in its statements,—decrying some people and trades, and extolling others (*to order*, apparently), with but small regard to the actual merits of either, that it soon ceased to be looked on with any respect, and has long since vanished from the list of books that are read. Dr. Normandy's work is something very different from Accum's, being written in a more fair spirit, and altogether trustworthy; yet still it is a long way from supplying the want in question, in the way we would have it done. The articles are treated of in alphabetical order, and in so far, it is of the ready-reckoner and dictionary class—easy of reference; but it is diffuse, and because of its diffuseness, unnecessarily bulky; the tests supplied are very generally such as scientific manipulators alone can promptly apply, and but seldom of a simple enough character for common use; many modes, too, of verifying each article are given, when, by a judicious selection and abridgment, space would have been gained to multiply largely the number of articles noticed—with a single good test for each.

We have spoken of the fair spirit in which Dr. Normandy's work is conceived, and of this we can adduce no better proof than an extract or two from his article on MILK, respecting which the public mind has very recently been exceedingly abused:—

"The quality of the milk sold in London and other large towns is always extremely variable. The frauds practised in that very important alimentary substance are of two kinds—frauds by addition and frauds by subtraction. The result of the practical working of these two rules applied to milk is always a *loss* to the consumer. Subtraction of cream, addition of water, of yellow colouring matter, of emulsions, of hempseed, &c., to give the milk a creamy or rich appearance which it does not really possess by itself.

"*Plaster and chalk*, and other substances of that kind, it is said, are sometimes added to milk; but that fraud, it would appear, is *much less frequent than is generally supposed*, doubtless on account of the facility with which such substances are detected, since, on leaving the vessel containing the milk at rest for a short time, they settle down as sediment.

. . . . .

"The addition of *gum arabic* to milk seems hardly probable, at least practically, since it scarcely affects the density of the milk. According to M. Quevenne, an addition of not less than 1582 grains per quart of water are required to bring it to a density of 1·030, which is about the density of milk. *The fraud would consequently be unprofitable, and consequently is not very likely to take place.*"

. . . . .

"According to M.M. Raspail and Barruel 2 per cent. of sugar added to milk are sufficient to impart a decided sugary flavour to it, and even 1 per cent. is sufficient to impart an unusual degree of sweetness—*sugar, therefore, can hardly be employed to augment the density of milk.*

. . . . .

"The experiments of M. Quevenne seem to prove that the *emulsion of hempseed and of almonds* cannot be employed for adulterating milk as *is generally supposed*, for hempseed communicates to the milk a very unpleasant flavour, and almonds very speedily coagulate it.

. . . . .

"As to the adulteration of milk by the addition of the *cerebral matter of various animals*, accounts of which were published by newspapers some time ago, it would appear from the experiments which were performed at that time by the "Conseil de Salubrité," that no *such admixture could be detected* in any of the considerable number of samples of milk which were then submitted to examination.

. . . . .

"The most frequent, and one might say the unexceptionable adulteration of the milk sold in towns consists *in the addition of water*."

And to detect the presence of water, which we make no doubt is intermixed with milk to a greater or less degree, *in all cases*, Dr. Normandy recommends the employment of the "galactometer"—a very simple instrument, which may be had of any philosophical instrument maker.

"The galactometer is simply a large tube divided into two equal parts. The milk to be examined is poured into the tube up to O, and the whole is left in a clean and cool place for ten or twelve hours in summer, and from fifteen to sixteen in winter. At the end of that time the whole of the cream will have risen up, and the quantity per cent. of the cream contained in the milk is then to be determined by the number of degrees occupied by the cream. The thickness or stratum of cream in *pure* milk is generally from 8 to $8\frac{1}{2}$. If the milk submitted to experiment has been mixed, for example with one-third of water, the quantity of cream produced will be reduced to $6\frac{1}{2}$; if mixed with half water, 5; and if adulterated with two-thirds of its volume, the cream is only 3 per cent of the bulk."

The sophistications of that other necessary of life, *bread*, are considered to be more frequent and undoubted—but they are all easy enough of detection.

"1. The substances which are employed for adulterating this most important of all articles of food, besides those which are enumerated in the article on *Flour*, are the following:—

Alum.................	Chalk.
Subcarbonate of magnesia..	Plaster.
Sulphate of copper	Lime.
Sulphate of zinc	Clay.
Subcarbonate of ammonia..	Starch.
Carbonate of potash	Water.
Bicarbonate of potash....	Pulp of potatoes.

"2. The introduction of *alum* in bread appears to be a practice of long-standing; it enables the baker to give to bread made of flour of an inferior quality the whiteness of the best bread, and to add potato-flour, ground beans and peas, to a certain extent, to wheat flour, without materially altering the appearance of the bread. The use of alum by bakers is almost universal in this metropolis; at any rate, I have invariably found distinct evidence of the presence of this material in the bread which I obtained from various bakers, some of which are esteemed of the highest *respectability*.

"3. The quantity of alum in bread varies however according to the quality of the flour employed, and it appears to act somewhat in the same manner as sulphate of copper, that is to say, it enables the baker to make bread with flour of inferior quality with less labour, and to introduce therein a greater quantity of water, by which the yield is increased. In order to obtain these results, however, a much larger proportion of alum than of the salt of copper is required, since, in fact, no appreciable effect is produced, when the proportion of alum is less than $\frac{1}{500}$, while with the salt of copper $\frac{1}{15000}$ is sufficient. Hence, although alum is of course very far from being so dangerous as the salts of copper, yet the constant ingestion of that matter, day after day, may prove a source of disease, especially with persons of weak constitutions, or of a bilious or costive habit; sometimes it creates a painful sensation in the stomach, and may even induce nausea, vomiting, gripe, &c.

"4. The process recommended by M. Kuhlman for the detection of alum in bread, consists in incinerating about 3000 grains of bread, porphyrising the ashes so obtained, treating them by nitric acid, evaporating the mixture to dryness, and diluting the residuum with about 300 grains of water, with the help of a gentle heat; without filtering, a solution of caustic potash is then added, the whole is boiled a little, filtered, the fil-

trate is tested with a solution of sal-ammoniac, and boiled for a few minutes. If a precipitate is formed, it is alumina, which may be collected on a filter, washed, perfectly dried, carefully ignited in a platinum crucible, and then weighed. 50 grains of alumina represent 332 of crystals of alum.

"5. *Another process*, indicated by Messrs. Robine and Parisot, consists in crumbling down about 2000 grains of the bread under examination, which should be somewhat stale or dried, in order that it may be more easily crumbled. The mass should be macerated in cold water for two or three hours, and then squeezed through a clean piece of white linen. The liquor thus obtained should now be filtered, and the filtrate being placed in a porcelain capsule, should be evaporated to dryness at a steam heat. The residuum being now treated by a small quantity of water and filtered, the operator divides the filtrate into two portions.

"6. If aqueous ammonia, or a solution of sal-ammoniac, being poured into one of these portions, and solution of chloride of barium in the other portion, produce in each of them a white precipitate, it is a sign of the presence of alum. That produced by ammonia, more especially, is conclusive.

"7. The experiment should be performed in the way indicated; for if the operator were merely to filter the liquor squeezed from the linen, and at once add solution of chloride of barium thereto, a precipitate or milkiness would be produced, which might be mistaken for sulphate of baryta, but which would be coagulated vegetable albumen, &c. The filtrate should therefore be first boiled or evaporated to dryness, and the dry mass being digested in water and filtered, may then be examined, as was said; or the liquor squeezed from the linen may be at once boiled, then filtered, and the filtrate may next be treated by ammonia and by chloride of barium, taking care to concentrate the filtrate, if too bulky, before testing; but the proportion of alum is generally large enough to become readily perceptible in the unconcentrated filtrate when tested by ammonia, which produces a white flaky precipitate, as we said."

Beer is one of the worst and most hopeless cases in the book. Water fanatics may rejoice; but we, who deem it a pity that a beverage so wholesome when pure and used in moderation, should not always be of the best, can but lament over the sophistications which are here disclosed.

"It is a well-known and authenticated fact that many dealers in, or retailers of beer, in the verbose phraseology of the Act, have in their possession, and do make use of, mix with, or put into their beer, liquors, extracts, preparations, calx, and all manner of substances, except brown malt. It is a publicly known fact that carts may be seen bearing the inscription, in staring paint, of '——, brewers' druggist.' Such a cart I have myself seen, a few days ago, standing in broad daylight, at mid-day, before a publican's shop or gin-palace. Of course I do not know what the contents of the cart were, nor whether it contained anything; but since the inscription painted upon it indicated the trade of the owner to be that of a *brewers' druggist*, it may fairly, I think, be inferred that the man was a dealer in drugs for the use of dealers in or retailers of beer, spoken of in the Act; that the publican was probably a customer of his, or that endeavours were made to induce him to become one; at any rate, the above facts prove that, since there are beer druggists, there must be beer druggers; consequently, that if the purpose of the Act be useful, the Act itself is powerless, and that some more efficient protection should be resorted to."

. . . . .

"If it contains common salt, which is almost generally found in beer in considerable and unwarrantable quantities, for the purpose doubtless of increasing the thirst of customers, and inducing them to consume larger quantities of the liquid than they otherwise would, its presence may be detected, and its quantity estimated, by means of a solution of nitrate of silver, which in that case produces a precipitate which is insoluble in water and in nitric acid. The precipitate may then be washed, dried, fused in a small porcelain crucible, and weighed. 134 grains of chloride of silver = 60 grains of common salt.

"Sulphate of iron (green copperas) is sometimes added to beer for the purpose, it is said, of *creating a head*; but whether for this or any other purpose, it is a dangerous addition, which has, to my certain knowledge, created vomiting, cholic, and other symptoms of gastro-intestinal irritation. In order to detect the presence of this salt, the beer should be decolorized as much as possible by animal charcoal, filtered, and the filtrate being tested by hydrosulphuret of ammonia, will then produce a black precipitate; by ferricyanide of potassium, a blue precipitate.

"On the other hand, if a solution of chloride of barium be added to another portion of the filtrate, a white precipitate of sulphate of baryta will be produced, which may be filtered, washed, dried, ignited, and weighed. 117 grains of sulphate of baryta

represent 139 grains of crystallized proto-sulphate of iron.

"The presence of opium may be detected as follows:—The suspected beer is first to be decolorized as much as possible, by animal charcoal; a portion of the filtrate is then poured into a conical glass, and a few drops of acetate of lead are poured in. In the course of about twelve hours, or sooner, a precipitate will be produced, especially by stirring the whole from time to time, which is a meconate of lead. The precipitate which will have collected at the bottom of the test-glass is then separated from the supernatant liquor by careful decantation, and 30 or 40 drops of sulphuric acid, and a like quantity of protosulphate of iron are then poured on the meconate of lead at the bottom of the test-glass. By this treatment the meconate of lead is decomposed and converted into sulphate of lead, whilst the liberated meconic acid, re-acting upon the protosulphate of iron, produces a beautiful red colour."

For testing the strength of *brandy* and all sorts of spirits, Dr. Normandy recommends the employment of that valuable instrument, Field's Alcoholmeter, sold by Messrs. Long, of Tower-hill, and described in *Mech. Mag.*, vol. xlvii., p. 479.

Under the head of *chocolate*, we find a very notable case of adulteration recorded.

"Chocolate is a preparation of the cocoa-nut, obtained by grinding the nuts, previously roasted and shelled, in an apparatus, which consists either of a flat stone with a steel cylinder, or of conical stone rollers revolving on a circular table of the same material, or of a mill of a peculiar construction. The mill, or the stones, are heated to about 212° Fahr., and the roasted and shelled cocoa-nuts are submitted with sugar to the grinding operation, by which they are reduced into a syrupy mass, which is received into moulds of various shapes, in which it hardens in cooling.

"Besides cocoa-nuts and sugar, the manufacturer generally adds some arrow-root, many persons preferring the chocolate so prepared, because the oil or butter of cocoa is thereby rendered emulsive and more digestible. The preparation known as *cocoa-powder*, or chocolate powder, when genuine, consists only of cocoa-nibs, sugar, and arrow-root, mixed and ground together, and then pulverized, by passing the mass through a grating-mill, and cooling it.

"Chocolate, as well as cocoa-powder or flakes, prepared as above said, is one of the most grateful, nourishing, and easily digestible articles of food; it belongs to the class of perfectly alimentary substances. Unfortunately, however, many of the preparations of the cocoa-nut, sold under the name of chocolate, of cocoa flakes, and of chocolate powder, consist of a most disgusting mixture of bad or musty cocoa-nuts, with their shells, coarse sugar of the very lowest quality, ground with potato-starch, old sea-biscuits, coarse branny flour, animal fat (generally tallow, or even greaves). I have known cocoa powder made of potato-starch, moistened with a decoction of cocoa-nut shells, and sweetened with treacle; chocolate made with the same materials, with additions of tallow, and of ochre. I have also met with chocolate in which brick-dust or red ochre had been introduced to the extent of 12 per cent.; another sample contained 22 per cent. of peroxyde of iron, the rest being starch, cocoa-nuts with their shells, and tallow. Messrs. Jules, Garnier, and Harel assert, that cinnabar and red lead have been found in certain samples of chocolate, and that serious accidents had been caused by that diabolical adulteration.

"Genuine chocolate is of a dark brown colour; that which has been adulterated is generally redder, though this brighter hue is sometimes given to excellent chocolate, especially in Spain, by means of a little annotto. This addition is unobjectionable, provided the annotto is pure, which, however, is not always the case.

"Genuine chocolate should dissolve in the mouth without grittiness; it should leave a peculiar sensation of freshness, and after boiling it with water, the emulsion should not form a jelly when cold; if it does, starch or flour is present. The admixture of flour, or of starch, moreover, may be readily detected by the blue colour which is imparted to the decoction, after cooling, by solution of iodine.

"*Brickdust* and other *earthy matters* are detected by incinerating a given weight of the chocolate or cocoa under examination; the impurities remain among the ashes, and may be easily recognized. This adulteration is also readily detected by grating 500 grains of the chocolate in as fine a powder as possible, throwing it into about half a pint of cold water, stirring the whole briskly for about ten minutes, leaving it at rest for about two minutes, and decanting the supernatant liquor. The earthy matter will then have subsided, and will be left as sediment.

"The presence of *animal fats* may be detected by the palate, for the chocolate generally has, in that case, a cheesy flavour; or, when common butter, or oil has been added, it has a rancid flavour. This is quite

characteristic; for butter of cocoa always remains perfectly sweet.

"The presence of *animal fats*, or of *oils*, may also be recognized by saponifying a portion of the chocolate as follows:—Rasp about 2000 grains of the chocolate under examination, and boil them with water and some caustic potash. When the fat has saponified, dilute the mass with a sufficient quantity of water, and filter three or four times. The miky filtrate, which is, in fact, a solution of soap, should now be supersaturated with nitric acid; this will separate the fat, which will float on the liquor after cooling. It may then be collected on a filter, and on rubbing a small portion of it between the fingers, the odour will generally indicate its origin; but more effectually still, by heating it in a small capsule. Pure butter of cocoa has no odour.

"Or the chocolate may be exhausted by sulphuric ether, and by evaporating it the fat will be left behind, and may then be identified as we have just said.

"If the chocolate has been mixed up with the *ground shells* of the cocoa-nut, the use of the microscope is the best way of detecting it. Or, after having treated a given portion of the chocolate by ether, the residuum may be exhausted by hot water, which will extract all the soluble portions and leave again a residuum, in which the sharp spiculæ of the ground husks, if any be present, may be readily seen with the help of a magnifying glass.

"The presence of cocoa-nut shells in chocolate appears to be injurious to health. Dr. Ure relates in his "Dictionary of Arts, Manufactures, and Mines," that samples of chocolate made at the Victualling-yard, Deptford, for the use of the Royal Navy, and manufactured by the Government chocolate mills, were sent to him for examination, by order of the Lords of the Admiralty, under the following circumstances:—

"For sometime the chocolate, it would appear, had been distributed to sailors and convicts for their breakfast, at the rate of one ounce daily, when several of the men complained of its producing sickness, vomiting, purging, and other illness, and a few cases terminated fatally. A careful examination of the chocolate failed in detecting any impurity or deleterious substance, except that some gritty matter, incapable of mixing with water, and which, on closer examination, was found to consist of minute spiculæ of the cocoa-bean husks, which, when swallowed, became lodged in the villous coat of the stomach and bowels, where they created irritation and all the symptoms certified by several naval surgeons. 'It was obvious,' observes Dr. Ure, 'that from the insoluble condition of the chocolate, it could be of little use as an article of food, or as a demulcent substitute for milk, and that, in fact, *three-fourths of it were, on this account, an ineffective article of diet, or were wasted.*'

"12. In France, the chocolate paste has usually a little vanilla incorporated with it, and a considerable quantity of sugar, which varies from one-third of its weight to equal parts, and one pod of vanilla is said to be sufficient to flavour one pound and a half of chocolate. Pure, genuine chocolate improves in its flavour by keeping, which is the reverse with bad or adulterated chocolate, but the roasted beans soon lose their aroma if left exposed to the air."

We might fill many a column with additions to these extracts, equally interesting and useful; but we have quoted sufficient to show that, though Dr. Normandy may have missed producing exactly the sort of work that was wanted, he has produced one which, to the extent it goes, must have the approval of every fair trader and friend to sanatory improvement. It is, to say the truth, with all its faults, the very best book on the subject which the English press has yet produced.

GEOMETRICAL NOTES.* BY T. S. DAVIES, ESQ., F.R.S., F.S.A., ETC.

(Continued from page 154.)

I. *The Early Geometry of the Greeks and Egyptians.*

Again, for the similitude of quardrilaterals, it would be obviously only necessary that they should be composed of similar triangles, taken in the same order. The figures themselves are sufficiently suggestive of the process, without written details.

One of the very early conceptions of the mind, of the relations amongst magnitudes, is that of *ratio*; not, it is admitted, in a very precise or describ-

* The following is the note referred to at page 152, and should be read in connection with the passage at which the reference to it is made.

The earliest form of demonstration in point of time, though certainly not the most simple, must inevitably have been that which we now term *reductio ad absurdam*; or, at least, that shape of it in which we conclude that the allegation "cannot but be true," must have constituted the essence of the primitive geometrical logic. This may appear

able form, but still essentially and in fact. Indeed, it is one of those conceptions which is as clear to the unlettered as to the more cultivated mind—except that cultivation shall have been expressly inclusive of the doctrine as a special one; and there is no cause for scruple in asserting that, even amongst mathematicians themselves, of no mean standing, any conception at all more general, or even more clear, than this vague one common to men of all ages, exists! A more precise mode of expression, copied from Euclid, and a more recondite one by means of certain tests, may be given to it in their hands: but a more precise conception, and yet a more precise definition of it may be looked for in vain, in the great majority of cases. Were other proof wanting, the constantly-recurring disputations on the subject would supply it; but it would be easy to adduce others more conclusive than even this. Of this, however, more hereafter.

Ratio, or comparative magnitude, would appear simple enough, when one of the magnitudes is double, triple, *etc.*, of the other; and the equality of two ratios (or proportion) would be intelligibly expressed by stating that fact. The mere confusion of the words ratio and proportion, or more frequently the substitution of the latter term for the former, in common use in this country (perhaps in most languages, as it certainly is in many,) does not in the least degree confuse the elementary conception, though it may in some degree confuse the expression of it to the mathematician.

When, again, both the magnitudes are exact multiples of some other of the same kind, taken as a standard merit, the conception of the ratio is equally intelligible to all minds. Thus, if one magnitude were five times the standard-unit, and the other nine times the same unit, the idea of their ratio being that which 5 has to 9, is as distinct as can be desired. It is only when the two magnitudes have no standard-unit (or common measure), however small, that such persons become sensible of the want of universality in their view of ratio or proportion. The algebraist evades the difficulty in his own way, by saying that four magnitudes are proportional when "the first is the *same function* of the second that the third is of the fourth," or something to the same effect. It is only necessary to remark upon this, that the assumption of generalities by the mere generalisation of language, is of exactly the same logical character as the assumption of the proportionality in the cases above supposed, from finding that we can take our standard-unit so small, as to show the truth up to any required degree of approximation to the actual relation of the magnitudes. If, then, in virtue of the generality of the meaning attached to symbols, the algebraist thinks himself justified when he includes irrational or transcendental quantities under his equations, we surely cannot wonder that the ruder efforts of the primitive geometers should terminate in an analogous assumption of the corresponding generalisation.

It would be a mere waste of time to give the details by which the mind would pass from this consideration of ratio (or more strictly, of proportion,) to the fact

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startling to those who take the final scientific form of our reasonings as that in which they necessarily first made their appearance; a fancy often indulged by those who have never attended to the history of the gradual development of any branch of science.

Many of the earlier propositions in "*Euclid's Elements*" afford sufficient illustration of the method; and their occurring where they do, show that they are inevitably used there, whilst their gradual elimination in the later stages of the work (though never wholly), shows also that Euclid would have dispensed with this method of proof had it been in his power to do so.

It will be sufficient to take one single theorem of "*Euclid's Elements*" by way of illustration; and hence his very first may be chosen; namely, i. 4:—

"1. For if the triangle ABC be applied to the triangle DEF so that the point A may be on D, and the straight line AB on D, *therefore* the point B *shall coincide* with the point E." That is, as far as the logic is concerned, *cannot but coincide* with the point E.

"2. And AB coinciding with DE, *because* the angle BAC is equal to the angle EDF, *therefore* the straight line AC *shall fall on* DF." That is, *cannot but fall on* DF.

"3. Also *because* AC is equal to DF, *therefore* the point C *shall coincide* with the point F." That is, *cannot but coincide* with the point F.

In this form, from which the inference is changed to a direct one, all such arguments essentially make their appearance. It would be impossible, as it appears to me, for the Egyptian geometers to have stopped short of this mode of reasoning, except we assume their utter incapacity to reason at all. Moreover, as superposition was, of necessity, the earliest mode of comparing figures, so also must the particular mode of reasoning which that process requires, even to the present hour, be the earliest that was employed. The mode of dispensing with both, by rendering propositions already established subsidiary to the proof of others, might, indeed, have in a great degree been due to the Greeks: but that the Egyptian geometry did not contain some approximation even to this seems to be almost certain.

expressed in our current notation respecting the preceding figures:—

BK : KC : CB : BA : AC :: FH : HF : FE : ED : DF.

Geometry *as a science* requires certain *logical forms*, and till *modes of reasoning* shall have been devised, it can scarcely be deemed to be aught else than what Thomas Simpson has happily called mere "inspection." To this, little allusion has been made in the foregoing pages, except at the close of the note on p. 169; and in the paragraphs immediately preceding the present one. That little requires, therefore, some further expansion here.

Some doubt seems to exist as to the relative periods at which Aristotle and Euclid flourished. One writer, whose authority and judgment I should question with considerable diffidence on a question of this nature, makes them cotemporary, or nearly so; and infers that Euclid knew nothing of the existence of Aristotle's systematic arrangement of the different kinds of syllogism. That he did not make any use of it is clear at a glance; but if the ordinary chronology be received, we must look for other causes than the hypothetical ignorance of Euclid. In fact, it would rather appear that he altogether refused all recognition of the syllogism, in any other form than the enthymeme which he invariably uses. It is, indeed, probable that Aristotle's secession from the school of Plato originated in his enforcement upon the disciples of that school his own doctrines respecting formal Logic; and if this were so, it will readily account for the conservatives of Plato's school rejecting everything that originated with, or was ostensibly enforced by, the heretic-seceder. The Platonists opposed the Aristotelian logic to the last; and the purposes of "trifling," to which it was subsequently applied, seemed to furnish a strong argument in their favour in pursuing this course. A more fitting opportunity for discussing this question will occur further on in these notes, and I shall hence, having simply stated my view of the matter in general terms, defer it till then.

To this extent, then, it is perfectly possible that the study of scientific geometry might have been carried amongst the Egyptians; and when we consider the commercial activity and constructive skill of the people, and the contemplative leisure of the sacerdotal order, it can hardly be questioned as highly probable that they must have proceeded thus far. Any consistent interpretation, too, of the Greek writers themselves, must involve this concession to Egyptian progress in the science. For instance, the story of Thales and the king Amasis. If Thales went to Egypt as a *learner* in geometry, the application of similar triangles (or, indeed, any mode of solution) to the determination of the height of the Pyramids, implies that the Egyptians knew those properties before they taught them to the travelling philosopher. To question this, is tantamount to affirming that he went as a teacher of geometry, rather than as a learner,—contrary to the hypothesis and to the testimony of Diogenes-Laertius and Plutarch. Or again, how are we to reconcile his knowledge of similar triangles when in Egypt, with the statement of Proclus, that he *discovered* the very simple theorems which stand as i. 5, i. 15, i. 26, and iii. 31 of *Euclid's Elements;* or again, the construction of the problems which form iv. 2, 3, 4, 5 of the same work, and this, too, many years afterwards? The true state of the case probably is,—that Thales *invented the demonstrations of those several propositions*, in the *form* that Euclid adopted into his *Elements*. They are all so many removes from the method of proof by supraposition—so many steps towards that ideal perfection after which the Greek geometers laboured with such extraordinary zeal.

The story of Pythagoras, the "hecatomb," and the 47th proposition of *Euclid's* First Book, is too absurd for the acceptance even of those who generally think themselves "bound in honour" to believe every thing they find stated by an ancient writer. It is, however, rejected from its other impossibilities as a *complete* statement,—from the utter contradiction between the recorded views of Pythagoras and the sacrificial offering which it records him to have made. His *discovery* of i. 47 is, however, tenaciously adhered to, in spite of this absurd adjunct; although it is difficult to see the superiority of the evidence for one over the other. On the

face of it, the statement of the discovery by Pythagoras is not impossible; but upon a close inspection, it seems barely to stop short of the impossible.

The property itself is easily, and in many different ways, reducible to the method of transposition, for its proof.* It is precisely such a result as would be most likely to be first obtained in that way; and hence most likely to originate in the schools of Egypt. The connection of Pythagoras with this proposition is, hence, much more probably assigned to be—that he gave a demonstration of it independently of transposition, and probably almost identical with that which Euclid adopted into the "*Elements*." Indeed, the value to be attached to such authorities as are usually quoted on these subjects, cannot be better shown than in the statement of Proclus, that to Œnopides, who lived *after* Pythagoras, is due the *discovery of props.* 12 *and* 23 *of Euclid's First Book!* On the same authority, again, is attributed to Pythagoras the doctrine of incommensurables. If we reflect for one moment on the *origin* of incommensurables (the adoption of a standard-unit of measure) we shall see the utter absurdity of this statement. Pythagoras might have invented methods of *discussing them completely*, in the manner of *Euclid's* Seventh Book; or, which is far more likely, *methods of evading*, in his reasonings upon ratio, *all reference to a standard-unit* under any form. He might have laid down, in fact, the principles upon which Eudoxus and Euclid finally constructed their system of proportion, both geometrically and arithmetically. Indeed, if we read almost universally in these statements respecting times anterior to Plato, "improved the demonstration, or construction, or method," as the case may be, for "invented or discovered the proposition," we shall approximate much more nearly to the truth.

There is not much ground for thinking that geometry was cultivated as *a philosophy* so much as *a technical science*, before the time of Plato. Geometers were more intent upon new combinations and the new discoveries which may be made of the relations amongst the parts of a figure, than upon classifying elementary truths and improving elementary demonstrations, during the era between Pythagoras and Plato. With brief intervals of a different prevailing spirit, this has been the history of geometry in all ages, and amongst every people by whom it has been cultivated. If, indeed, we entertain a doubt as regards the Greeks of that period, that doubt must be founded on one of these two considerations:—

(1) Its incompatibility with the character of the Greek mind—which is, however, only inferential after all.

(2) The suspicion that must attach to the testimony of Proclus:—so vague and confused is it upon all subjects; and especially liable, from his position, to have his weak though versatile mind warped by prejudices. He was a Platonist; and finally became head of that once-illustrious school, and successor to the functions of Plato himself. The school was then in its lowest state of decadence short of actual extinction; and, as former fame was all that its disciples could then boast, the most would be made of this by such men as Proclus.

Notwithstanding these drawbacks from the trustworthiness of Proclus on such questions, there is to be set against them the testimony, direct or implied, of a much less credulous and vain writer—Pappus. Probability, suggested by circumstances of various kinds, also leans to the side of the representations of Proclus, in the rougher sense at least; and we run little risk of error in admitting that *methods*, as such, and the philosophical arrangement both of subjects and reasoning, took their methodised forms in and from the school of Plato.

Amongst these we may certainly consider the cardinal subjects to be,—the methodising of the form of an argument,—the discovery of the Geometrical Analysis,—the dispensation with incommensurables in treating ratio,—the method of exhaustions, the conic sections loci, and porisms, — and, finally, a purification of the reasoning in the "*Elements*" from much of its antecedent inconclusiveness, and especially (and to the utmost possible extent) from the prevailing use of the method of transposition.

* One of the simplest and neatest that I recollect to have seen, is that given by Lt.-Gen. Sir Howard Douglas, when a cadet in the Royal Military College, in Leybourn's Repository, New Series, vol. ii., p 12.

Though the main object of this dissertation is relative to the last-named topic, yet I trust, that a few short remarks upon the others, made *pari passû*, (some here, and some there,) will not be deemed out of place, nor wholly useless. They may not contain much that has not been said before by some geometer or other; yet they are such as ought to be more prominently put forward in educational works than is usual in the present age of mere symbolical manipulation. Since Science has "donned her seven-leagued boots" she cannot stop to notice such useless trivialities as philosophy, or method, or history!

(*a*) *The logical forms.*—Dr. Simson pertinently remarks (note on iii. 1.) that "several authors, especially among the modern mathematicians and logicians, inveigh too severely, and sometimes ignorantly enough, against indirect or apogogic demonstrations, not being aware that there are some things that cannot be demonstrated any other way." It has been further shown, in a preceding page, that this was, inevitably, the *earliest form* in which an argument could have been constructed for geometrical purposes. Though, it is equally clear, that the simple cases of the direct or categoric syllogism (most likely under the abridged form of the enthymeme) must have been likewise used at a very early period: yet this could in no case occur, till the method of transposition itself was replaced by an appeal to truths before established or admitted, — as forming an integral portion of the argument then under development. It does not, however, appear that any one before Aristotle completely analysed the cases of the syllogism; and fully developed the conditions under which an inference was *necessarily just*. The school of Plato had been established about fifty years when Aristotle seceded from it, to found his own Lyceum. His logical system must have been complete before he left his *alma mater;* as his own teaching lasted only twelve years, and his subjects were universal. It is not impossible that even at that early age, the school of Plato was split into factions, and that faction would call the doctrines of Aristotle "conundrums," or, at least, some corresponding term of derision; and that to teach his own doctrines in his own way was the main cause of his dissent from the body amongst whom he had passed twenty years of his life. His logical system, however, was complete; and to use the language of Mr. De Morgan, this and *Euclid's* Fifth Book are "the two most unassailable treatises that have ever been written."—(*Comp. Alm.* 1849.

As Euclid and Aristotle were disciples of the same school, and Euclid did not flourish till a reign that commenced after the flight of Aristotle, it would seem that Euclid's logical method is a type of the logic of the Platonic school even subsequent to the teaching of Aristotle. This, it need not be said, is of the simplest character; being confined to the abridged categoric syllogism, or enthymeme: and this is difficult to account for on any other hypothesis than that Euclid wished to denude his logic of all the peculiar attributes and special forms that had been introduced by Aristotle—that the "rawness" of his method in the disposition of his "materials" was unintentional. At all events we may infer the logic of Euclid to be that of the school to which he belonged, and which the founder of that school had taught.

A far more important question, however, is the province which properly belongs to logic in mathematical research. The schoolmen of the middle ages attributed to logic the office of an organon for discovery in every class of human knowledge; just as though *because* Aristotle took a wide range of subjects within the scope of his teaching, and likewise formed an organon for inference, it *therefore* followed that his logic was the only organon of natural knowledge, whether physical or metaphysical. The success of the new organon of Bacon in unravelling the laws of nature, and in part those of mind, has led by degrees to the almost entire abrogation of the use of the logical forms of Aristotle in all our researches whatever, and of trusting to "the common sense of mankind, and perceptive powers of every individual mind," for the conclusiveness of every argument. Yet even these "common-sense arguments" are neither more nor less than applications of the general principle of the Aristotelian syllogism, in its most simple and obvious forms. It is indeed urged that these are *sufficient* for the purposes of the mathe-

matician, and that it would be useless for him to trouble himself about other cases than those he requires. This may be partly true (it is not wholly true, at all events,) as far as the mere ordinary technical mathematician is concerned, as his sole ambition is merely the evolution of *other forms* of geometrical or arithmetical truth from those already existing: but there is a class of mathematicians, of a far higher intellectual order, to whose investigation and researches, this "mother-wit—form" of the categoric syllogism is *not* "*sufficient.*" Perhaps as a rule on this subject, as on many others, it is best that each person should study logic to the extent that his own want of it demands. Only there is this danger:—that a total ignorance of the subject, as one of scientific method, will prevent a person from perceiving what he really does require. He may be conscious of a want; but not know where to look for a correspondent supply.

It must be strongly enforced that the use of logic differs in one important feature in mathematics from its use in all others; though logical writers, for reasons which I cannot understand, give the same form to the syllogism in all cases. The conclusive form of the syllogism expresses the *identity* of two things. In mathematics, it expresses only the *equality* of them. This latter, indeed, is put under the form *identity of magnitude*, or *identity of the numbers* resulting from two separate series of operations: but this form is a forced one, easily perceived to be so, and it has probably militated not a little against the study of formal logic by the geometers of modern times. More than this, it is only in mathematics that logic has felt itself secure in its investigations:—its true province in all others being, in fact, to arrange every complicated argument in a form that shall enable us to consider the steps of the argument seriatim, and to ascertain by indisputable criteria *whether each successive conclusion inevitably follows from the premises of the syllogism.* With the truth of the premises it has nothing whatever to do: its sole function being that of justifying or invalidating the inference drawn. Yet, distinct and clear as we should have thought this principle to be, I am not aware of any author who has boldly avowed it and consistently acted on it in the composition of an entire work till the appearance of De Morgan's "Formal Logic," in 1847.

Finally, no conclusion can positively be obtained by the syllogism which was not virtually contained in the hypothesis of the proposition, or "juggled in" by some mistake or design into the premises of the successive syllogisms. Whenever the hypothesis of the figure is complete, all the results of that hypothesis, however complicated or remote, are *virtually* given too; for they inevitably flow in continuous succession from it, through the medium of successive syllogisms.

There is little liability to mistake in the use of the syllogism in geometry; but much more in the case of algebra. New conditions are liable to be imported into the equation by the character of the transforming operations, thus giving rise to those embarrassing members of a result known as "foreign factors," and otherwise affecting, both as to form and meaning, the result which is obtained. As a universal truth, however, it may be laid down—that *nothing can be got out of an equation that was not first put into it.*

This will, however, be better seen from a separate application to the theorem and the problem, to which the general expressions here employed will be readily made by the intelligent reader himself.

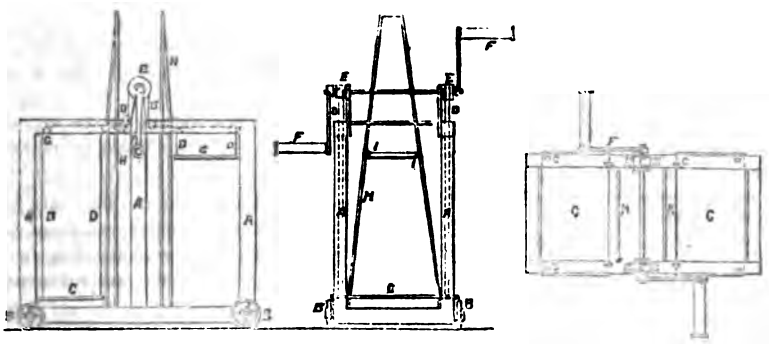
(*To be continued.*)

SACK ELEVATOR.

[Registered under the Act for the Protection of Articles of Utility. Thomas Moore Sharpe, of 17, Donegal-street, Belfast, Proprietor.]

Fig. 1 is a side elevation, fig. 2 an end elevation, and fig. 3 a plan of this apparatus. AA is a framework which is mounted upon wheels, BB. CC are two moveable platforms which are suspended by ropes or cords, DD, so that they may be raised or lowered at pleasure by means of the crane barrels EE, and crank handles FF. The ropes, DD, are passed over pulleys, GG, affixed within a slot formed in the upper rail of the framework, and are connected to the crank-barrels EE in such manner that the elevation of one platform causes the descent of the other. HH are supports for retaining the sacks

Fig. 1. Fig. 2. Fig. 3.



in an upright position; and H rollers to admit of the sacks sliding easily upon the supports.

This machine will be of considerable use to farmers, millers, &c.; its object being to enable a person filling sacks with grain or other substances to elevate the sack when filled to the required height for taking it upon his back without any other assistance.

THE HOLYHEAD AND DUBLIN STEAMERS.

Sir,—In my letter to you in May last, on the Holyhead steam-ships, I stated that the Government had determined on relinquishing the mail service, and had disposed of two of their vessels—the *Llewellyn* and *St. Columba*—to the City of Dublin Company, who had undertaken the mail contract.

The "celebrated *Llewellyn*"—as the *Morning Herald* has it—being at the time of agreement again *hors de combat*, having broken her main shaft, the Government were compelled to lend the Company the *Banshee* to supply her place. Up to the present time, I believe the *Llewellyn* has not made her appearance; and I wish the Company joy of their precious bargain: they would, I hear, have been only too glad to have got the *borrowed vessel* instead. The following is a return which has recently appeared of the performances of the Holyhead boats for the past month (July): by it you will see the *Banshee* was at the top of the tree. Indeed, I think she will always merit the high character you have given her on a previous occasion, in classing her amongst the best specimens of British steam-ships.

Performances of the Holyhead Mail Steam-Ships—Banshee, Eblana, Iron Duke, and St. Columba, for July, 1850.

Vessel.	No. of Voyages.		Shortest Voyage.		Longest Voyage.		Average Voyage.
Banshee........	37	....	3·50	....	4·48	....	4·7
Eblana........	44	....	4·20	....	4·50	....	4·34
Iron Duke......	1	....	4·59	....	——	....	——
St. Columba....	41	....	4·11	....	5·26	....	4·31

We had, on the 13th instant, another trial of speed between the *Banshee* and her old rival the *Scotia*. The former having been specially engaged for the service of the Lord-Lieutenant, who came down to Holyhead by the express train, left consequently at the same time as the railway boat, which happened—whether intentionally or not I cannot say—to be the *Scotia*. It was a more neck-and-neck race than on the last trial, in May, 1849—the *Scotia* obtaining an advantage of 3½ minutes over the *Banshee*. The time occupied in the run to Kingstown by the two vessels was as follows:—

	h.	m.
Banshee..........	3	50
Scotia	3	46½
Difference in favour of *Scotia*		3½

I have not yet been able to peruse the evidence of the Committee of the House of Commons on the claims of the Railway Company with respect to the mail service, but I understand Capt. Frazer, the Admi-

ralty Superintendent at Holyhead, when examined on the subject of the former trial, tried hard to prove that the *Banshee* was in better trim than the *Scotia*, and laid much stress on the fact of the latter having had a recent overhauling at Liverpool. Now the fact is, that the effect of these alterations was to diminish her pressure and increase her draught! The *Scotia's* pressure previously was 13, and at the time of the trial only 10, while the *Banshee* was 12. Both are certainly splendid ships, but the *Scotia* is, beyond all question, the fastest, and such specimens of the *suppressio veri* and *suggestio falsi* as one sees continually in journals like the *Herald* and *United Service Gazette*, can only injure the cause of the parties they espouse. Honesty is the best policy.

I am, Sir, yours, &c.,
L. M.

Dublin, Aug. 20, 1850.

Note.—The *Eblana* and *Iron Duke* belong to the original stock of the City of Dublin Company; the former was built and engine-fitted by Tod and McGregor, of Glasgow, and the latter by Wilson, Fawcett, and Preston, of Liverpool. Both are better adapted for more lengthened passages; but it would perhaps be difficult to point out a vessel of her class which has given more satisfaction than the *Iron Duke*. The *Duke* was built in 1844, and the *Eblana* in 1849; both are of iron—the engines of the former on the beam principle, the latter of the steeple class, but not so satisfactory in their working by any means.

FALL OF ANOTHER IRON STRUCTURE.

On Wednesday, the 24th inst., the roof of the "Bricklayers' Arms Terminus" of the South-Eastern Line, which was 400 feet in length, and divided into two compartments, each of 50 feet span, fell to the ground, killing one person instantaneously, and seriously maiming others for life. A train had only a few minutes before passed out of that terminus; and the preceding week it is stated that about 150 workmen had been employed under that very roof. It is little short of a miracle, then, that the loss of life was so small. It seems that, in "shunting" an engine, it slightly touched one of the iron pillars; that this touch broke the pillar, and that the breaking of this one pillar brought the entire roof down! Will any one contend that the pillar itself had been adequately tested prior to erection?—Or still more, would any competent engineer construct an immense roof, such as that, so as to be dependent on the safety of one single support?

There is the less apology for the engineer of the Bricklayers' Arms Terminus, that the present is not the first accident which has befallen the same structure. Six years ago the same roof came down; and there can be little apology for erecting it again in nearly the same manner—except the niggardly principle of *using up the old materials*. Strange to say, however, an inquiry into the competency of the engineer has been decided by Mr. Carter, the Coroner for Surrey, to be beyond the functions of the Jury! "The Coroner observed, that *it formed no part of the duty of the Jury to inquire into the stability of the building*, but that their attention ought rather to be directed to the means which had caused its destruction and the death of the unfortunate man."—(*Times* Report, Aug. 24.) And, again:—"The Coroner here addressed the Jury, and observed, that *no further evidence could be adduced* to throw any additional light on the transaction. The engine-driver, if any one, was the only person who could be blamed, and therefore it was not desirable to examine him. Their attention should be directed only to the *immediate cause* of the accident, and *not to the building itself or the nature of its construction*."—(*Ib.*) This is extraordinary doctrine; and no doubt Mr. Carter's "testimonial" from the Central Railway Committee is already in progress. We have yet, however, to learn what the views of the Home Secretary on this question may be;—of the views of the Public generally there is no room left for doubt. If, however, Mr. Carter's interpretation of the functions of a Jury be correct, the sooner the expensive farce of the "crowner's quest" be abolished the better; and then, at all events, Parliament will be compelled to devise some efficient machinery for protecting the Public from this class of "accidents."

MR. FRANK FORSTER'S PLAN FOR THE DRAINAGE OF THE SOUTHERN PARTS OF THE METROPOLIS.

Sir,—Our attention has been called to Mr. Forster's Report on the Drainage of the Kent and Surrey Districts.

Knowing the deep interest you have always taken in the Metropolitan Sewage question, we are induced to send you, on the one hand, the following extracts from our concise statements sent in to and printed for the Commissioners of Sewers in August and October last, and on the other extracts from Mr. Frank Forster's Report.

Messrs. Dredge and Stephenson's Plan, Aug. 24th, 1849.	*Mr. Frank Forster's Plan, Aug. 1st, 1850.*
	"I have adopted the following principles for my guidance."
"We propose the sewer to be divided into sections, each having a sufficient *inclination* to generate a stated velocity, this inclination* being obtained by *lifts* at certain stations, where the sewage will be pumped up by steam power in a *closed shaft.*"	"3rd. To maintain a continual and unintermitting flow, with the aid of *lifts* where necessary, in all the sewers along their whole length, by which the evils arising from pent up sewerage may be avoided." "To construct the sewers at *inclinations* so proportioned to the volume of fluid to be carried off by each, that the velocity of the current shall keep them clear of deposit." "This lift and shaft I propose to place *completely under cover.*"
"The *separation* of the sewage from the surface waters."	"To provide a natural escape by the power of gravity alone for storm waters and land floods, *independent* of the ordinary sewers."
Oct. 12th, 1849. "Running a main outfall sewer along the line of the Grand Surrey Canal, and having one engine station near Cold Blow Farm, where the sewage will be pumped over the surrounding country, or pumped through a pipe into the river *below Greenwich marshes.*"	"I beg to recommend the top of Woolwich Reach as the point for delivering the sewage into the river." "The course of the main sewer will be across Greenwich Marshes, Trafalgar-road to the Ravensbourne, across Union-street and Collier-street, where the south main line diverges. This continues by Loving Edward's-lane, along the Old Kent-road to Surrey Canal Bridge, along Albany-street in a straight line across to St. Mark's Church, Kennington."

We consider it due to ourselves to give you the foregoing facts, to show you our real position in this matter, our Plans and Report having been returned with the Commissioners' stamp affixed, and no further notice taken of them, while many other engineers, who suggested a different principle, were prominently brought before the public. Our Plans and Report, stamped by the Commissioners, are at our offices, and are at your service for examination.

We are, Sir, yours, &c.,

DREDGE & STEPHENSON.

10, Norfolk-street, Strand,
August 19, 1850.

* 1. The inclination shown in our plans for the north side of the river varies from 7 to 4 feet per mile; average, 5 feet. For the south we have merely specified that it shall be similar to the north.

2. On the Surrey side we only proposed one lift, which was to be placed near Cold Blow Farm.

1a. Only one lift is mentioned by Mr. Forster, viz., that at Ravensbourne, about a mile across Market-gardens from Cold Blow Farm.

2a. Mr. Forster states the average inclination to be 4½ feet per mile; more, of course, as the volume of fluid diminishes at each successive ramification of the sewers.

We see no difference in principle between these two plans, though undoubtedly the one may be worked out more in detail than the other.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING AUGUST 29, 1850.

George Gwynne, Sussex-square, Middlesex, esquire. *For improvements in the manufacture of sugar.* Patent dated February 27, 1850.

This invention consists in the employment of an oxide of lead, by preference litharge, in the clarification of sugar; for this purpose a quantity of litharge is moistened with water, and ground up with twice its weight of sugar. The mixture, termed by the patentee "saccharide of lead," is then passed through a sieve into the "blow up," or clarifying vessel containing the sugar solution, which is heated to the requisite temperature by steam or otherwise, and subsequently filtered. The lead is rendered insoluble by means of any suitable chemical agent, such as sulphuric or oxalic acid, &c., and separated from the clear liquor by filtration. The patentee prefers, however, to employ a solution of phosphate of soda and lime, rendered slightly acid. The proportions given are 40 lbs. of litharge to one ton of raw sugar. Instead of an oxide of lead (litharge) a basic acetate of lead may be used, which is formed by combining litharge with acetate of lead, or its equivalent of acetic acid. In this case the lead is rendered insoluble by means of a solution of phosphate of soda and lime, rendered slightly alkaline instead of acid, as before.

Mr. Gywnne describes lastly the application to the vacuum pan of a condenser, in combination with the air-pump, for the purpose of condensing whatever steam is evolved from the sugar solution, and thereby preventing its escape to the air-pump.

Claims.—1. The employment of oxide of lead in the clarification of sugar, and the mode of rendering it insoluble.

2. The employment of a basic acetate of lead in the clarification of sugar, and the mode of rendering it insoluble.

3. The improvements in the construction and working of vacuum pans.

Julius Jeffreys, Bucklersbury, London, gentleman. *For improvements in preventing or removing affections of the chest.* Patent dated February 27, 1850.

This invention relates to improvements in the construction of respirators, and consists chiefly—

1. In substituting for the ordinary front of woollen fabric a number of metallic leaves which overlap one another without touching, and between which the air is drawn or expelled.

2. Instead of perforated plates to warm the air, it is proposed to employ rods or tubes, or a number of plates, embossed here and there to maintain them at a small distance apart from each other.

3. The respirators are to be supported by metallic springs, similar to those used for spectacles, which may be made to pass over the ears or round the neck to suit the convenience of the wearer.

No Claims.

George William Lenox, Billiter-square, London, chain-cable manufacturer, and William Roberts, foreman to Messrs. Brown, Lenox, and Co., Millwall. *For improvements in working windlass and other barrels.* Patent dated February 28, 1850.

The patentees describe and claim—

1. The application of flexible metallic bands, which are worked by levers so as alternately to contract and grip the barrel and to expand and release it, whereby it will be caused to make a series of partial revolutions.

2. An apparatus for stopping chain cables, which consists of a shaft fitted with a groove, to allow the passage of the vertical links, and with projections to intercept the horizontal links: the shaft is provided with a break for the purpose of stopping or retarding its revolution, and, consequently, the paying out of the chain.

George Tosco Pepe, Great Marylebone-street, Middlesex, C.E. *For improvements in time-keepers.* Patent dated Feb. 28, 1850.

The patentee describes and claims a time-keeper, which consists of a glass tube bent into the shape of a link. Two plugs of wood are placed in one of the sides, equidistant from a point where the tube is fused and contracted until the bore is reduced to the required diameter. A column of mercury is then introduced above one of the plugs, and the two ends of the tube are fused together and closed to exclude the air. Supposing the tube to be suspended in a vertical position, with the mercury on a higher level than the top plug, then, in consequence of this latter being impermeable to the mercury but permeable to the column of air beneath, it will descend the other leg at a rate which will be regulated by the passage of air through the contracted portion between the two wooden plugs. A graduated cylinder is fixed between the two parallel sides, which will indicate the time as the mercury successively passes the marks. Just before the mercury reaches the bottom, the position of the tube is to be reversed.

James Hall, Geecross, Stockport, Chester, machine-maker. *For certain improvements in looms for weaving.* Patent dated February 25, 1850.

Claims.—1. Certain improved arrangements for working the shuttle, and the application of metallic bands to give motion to the picking sticks.

2. An improvement in unwinding the warp from the beam, and keeping it at a uniform degree of tension.

3. A method of maintaining the healds at a uniform tension.

4. A mode of stopping the working of the loom in the absence of the weft, or when the shuttle fails to enter the box.

5. Certain improvements in roller temples.

GEORGE ROBARTS, Tavistock, Devon, gentleman. *For certain improvements in clogs and pattens.* Patent dated June 19, 1850.

The patentee describes and claims an improvement in the construction and arrangement of clogs and pattens, which consists in making the heel-piece moveable, and fitting it with a spring which pushes it forward towards the toe part, and consequently clips the foot so as to remain firmly attached thereto. When it is desired to remove the foot, the heel-piece is released from the pressure of the spring by an arrangement which allows the heel-piece to fall back.

MATTHEW COCKRAN, High-street, Paisley, manufacturer. *For improvements in machinery for the production and ornamenting of fabrics and tissues generally; parts of which improvements are applicable to the regulation of other machinery, and to purposes of a similar nature.* Patent dated February 27, 1850.

The patentee describes and claims—

1. An improved punching machine for perforating the pattern in the cards employed in Jacquard machines, and which may be used to notch or indent the "edge cards."

2. The employment of cards for the purpose of actuating the needles, which have the pattern notched or indented on their edges, instead of flat perforated cards.

3. An improved construction of Jacquard machine, which has for its object an economy in the first cost, and a more regular and accurate working of the needles.

4. An improved construction of Jacquard printing machine, which has for its object an economy in the first cost, together with the power of reading the pattern on to the cards or sheet, in separate and detached colours, in one continuous line of needles.

5. The application of the improved dropneedle arrangement to the regulation of the supply of feed water to steam boilers, the working of pumps, and other purposes of a similar nature.

6. The employment of a self-adjusting power lever, in which, as the resistance increases, the lever power increases in a like ratio.

BRERETON TODD, of the Bank of Falmouth, gentleman. *For improvements in the manufacture of arsenic, sulphuric acid, and the oxide of antimony from copper and other ores in which they are contained, and also the oxide of zinc.* Patent dated February 27, 1850.

The patentee describes and claims the submitting of copper and other ores, in an uncalcined state, to the oxygenating and reducing action of a blast furnace, in connection with chambers or flues, and the application of the spare heat from the blast furnace to a calcining or reverberatory furnace in connection therewith. The volatilized products evolved are carried into the chambers, where they are condensed, and subsequently operated upon to render them available for the purposes of commerce, while the non-volatilized products are obtained in the form of regulus in the bottom of the furnace, whence they are removed to the calciner.

Specifications Due, but not Enrolled.

JOHN STEPHEN WOOLRICH, of Wednesbury, Stafford, chemist; JOHN JAMES RUSSEL, of Handsworth, in the same county; and THOMAS HENRY RUSSEL, of Wednesbury, aforesaid, patent tube manufacturers. *For improvements in obtaining cadmium and other metals, and products from ores, or matters containing them.* Patent dated February 21, 1850.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in cutting types and other irregular figures. (Being a communication.) August 29; six months.

George Augustus Huddart, of Brynkir, Caenarvon, Esq., for certain improvements in the manufacture of cigars, and certain improved apparatus for smoking cigars. August 29; six months.

LIST OF SCOTCH PATENTS FROM 22ND JULY TO 22ND AUGUST, 1850.

Richard A. Brooman, of the Patent-office, 166, Fleet-street, London, Patent Agent, for improvements in types, stereotype plates, and other figured surfaces for printing from. July 26; six months.

Donald Beatson, or Stepney, Middlesex, mariner, for certain improvements in instruments for taking, measuring, and computing angles. July 29; six months.

Joel Spiller, of Battersea, Surrey, engineer, for improvements in cleaning and grinding wheat, and other grain. July 29; six months.

William Edward Newton, 66, Chancery-lane, Middlesex, civil engineer, for improvements in machinery or apparatus for making hat bodies, and other similar articles. July 30; six months.

John Gwynne, of Landsdowne Lodge, Notting-hill, merchant, for improvements in obtaining motive power, and in applying the same to given motion to machinery. July 31; six months.

Walter Neilson, of Hyde Park-street, Glasgow, engineer, for improvements in the application of steam for raising, lowering, moving, or transporting heavy bodies. August 2; six months.

George Gwynne, of Sussex-terrace, Middlesex, Esq., for improvements in the manufacture of sugar. August 7; six months.

William Cox, of Manchester, Lancaster, cigar merchant, for improvements in machinery or apparatus for manufacturing ærated waters, or other such liquids. (Being a communication) August 7; six months.

William Edward Newton, 66, Chancery-lane, Middlesex, civil engineer, for improvements in obtaining, preparing, and applying zinc, and other volatile metals, and the oxides thereof, and in the application of zinc, and ores containing the same, to the preparation or manufacture of certain metals, or alloys of metals. (Being a communication.) August 8; six months.

Matthew Gray, of No. 3, Morris-place, Glasgow, Lanark, practical engineer, for an improved method of supplying steam-boilers with water. August 9; four months.

William Watt, of Glasgow, manufacturing chemist, for certain improvements applicable to inland navigation, which improvements, or parts thereof, are also applicable generally to raising, lowering, or transporting heavy bodies. August 13; six months.

George Augustus Huddard, of Brynkir, Carnarvon, Esq., for certain improvements in the manufacture of cigars. August 14; six months.

James Rennie, of Gowan-bank, Falkirk, Stirling, gentleman, for a certain improvement or improvements in the construction of gas retorts and furnaces, and in apparatus or machinery applicable to the same. August 14; six months.

William Charles Bell, of Manchester, Lancaster, for improvements in apparatus connected with water-closets, drains, and cesspools, and gas and air traps. August 14; six months.

Henry Meyer, of the Strand, Middlesex, gentleman, for certain improvements in power-looms for weaving. August 14; six months.

Read Holliday, of Huddersfield, for improvements in lamps. August 14; six months.

William MacNaught, of Rochdale, Lancaster, engineer, for certain improvements in steam engines, and also improvements in apparatus for ascertaining and registering the power of the same. August 16; six months.

Alfred Holl, of Greenwich, Kent, for improvements in steam engines. August 16; six months.

William Edward Newton, 66, Chancery-lane, Middlesex, civil engineer, for improvements in the construction of ships or vessels, and in steam engines, boilers, or generators. (Being a communication.) August 20; six months.

Edward Highton, of Clarence Villa, Regent's-park, Middlesex, engineer, for improvements in electric telegraphs, and in making telegraphic communications. August 21; six months.

Charles William Lancaster, of New Bond-street, Middlesex, gunmaker, for improvements in the construction of fire-arms, cannon, and projectiles, and in the manufacture of percussion tubes. August 21.

William Dick, of Edinburgh, professor of veterinary medicine in the Edinburgh Veterinary College, for improvements in the manufacture of steel and gas. August 22; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design
Aug. 22	2415	Schofield, Brown, Davis, and Halse	Gresham-street, London	The University Cravat.
23	2416	J. Swain and Co.	Oxford-street	The Syrian Paletot.
,,	2417	J. Swain and Co.	Oxford-street	The Syrian Jacket.
24	2418	Samuel Rooke, junior	Whitehall-street, Birmingham	Oxonian Ink-pot.
,,	2419	Bernhard Samuelson	Banbury, Oxford	Beater to be used in making butter.
27	2420	William G. Armstrong	Elswick Engine Works, Newcastle	Hydraulic equalizer.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1413.] SATURDAY, SEPTEMBER 7, 1850. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

STEAM PLOUGHING. BY LORD WILLOUGHBY DE ERESBY.

No. 2.

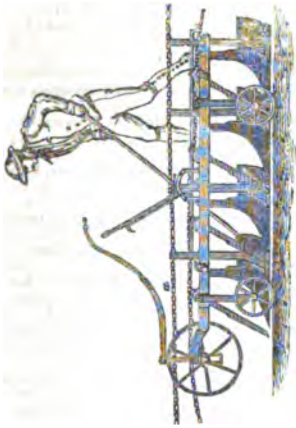


Fig. 4.

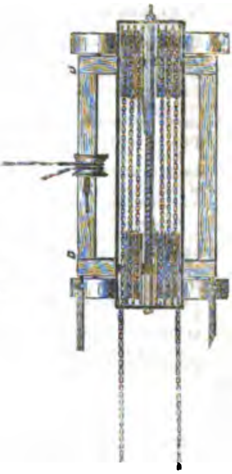
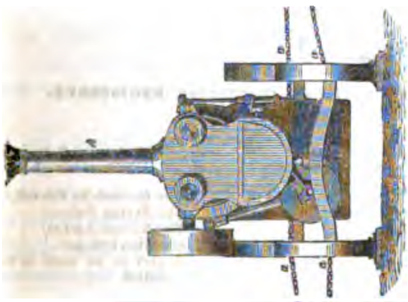


Fig. 1.



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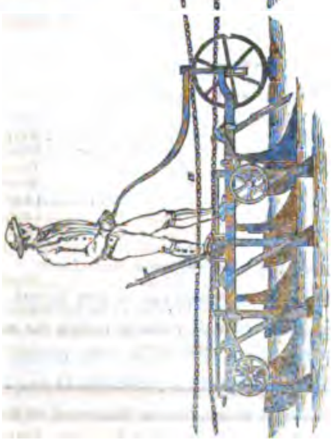
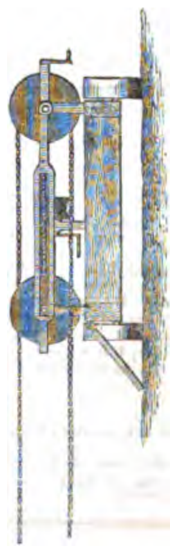


Fig. 2.



PLOUGHING BY STEAM. BY THE RIGHT HONOURABLE LORD WILLOUGHBY DE ERESBY.

Many of my friends being anxious to consider my proposed method of substituting steam power for horses in ploughing, I subjoin a plan and explanations of the different parts of my steam plough.

It will not be in my power to show the plough in proper working order for three or four months to come. The experiments hitherto have been made merely with a view to establish the principle, avoiding expense in construction; but I may with safety affirm that they have been attended with great success.

The machinery employed consists of the "California," a locomotive engine, weighing 3½ tons, and of a twenty-six horses power (see fig. 1.) (It was designed by Mr. Gooch, to whose friendship on this, as on many other occasions, I am so greatly indebted.) It has a double capstan attached, removable when the engine is required for other purposes.

The engine moves across the centre of the field on a light portable railway. The ploughs advance and recede on either side of the railway, at right angles to it.

The plough employed consists of four ordinary, and the like number of subsoil ploughs, fixed in a frame: it is directed by a person standing upon a small platform.

Two such ploughs, one on either side the railway, alternately advance and recede; the advancing plough working, the other idle until it regains its proper position for ploughing the next four furrows. On the completion of the four furrows both ways, the engine and side frames advance each three feet.

The ploughs are attached to an endless chain, 150 yards in length. They can be detached at pleasure, or shifted from one side the chain to the other. They travel at the rate of five miles an hour. Provision is made in case they strike against any impediment. There is also a provision on the carriage, as shown in fig. 2, for tightening the chain at the fences, by which the length may be varied forty feet, to suit irregularly-shaped fields. If any further alteration is necessary, the chain is made in thirty feet lengths, one of which can be added or taken out as required.

The full power of the engine is not exerted with the ploughs above described; and the number of blades can therefore be increased, if experience proves it to be advisable.

In the present state of things it is difficult to form a correct estimate of the value of the invention in a commercial point of view. I will only say, that a machine of the power, and with the arrangements described, would perform the work usually done by sixteen ploughs, driven by as many men, and drawn by thirty-two horses. Requiring itself the attendance of eight men, and a horse to draw the water for the engine, it would thus save the labour of thirty-one horses and eight men. Against this must be set an expense of five shillings a day for coals, as well as 10 per cent. upon the value of the machinery, say three shillings a day upon an original cost of 450*l.* to 500*l.* This latter item, however, would be fully compensated by the saving in the interest of capital now laid out on horses.

The machinery is only calculated for the cultivation of flat land. It might possibly be used with advantage in the West Indies.

Willoughby de Eresby.

Grimsthorpe, Bourne, Lincolnshire,
July 29, 1850.

*Description of the Engravings.**

Fig. 1 represents the ploughing apparatus in two different positions, No. 1 showing the plough and subsoilers advancing, and No. 2 the plough receding, with the subsoilers raised to clear the ground. A is the stationary steam engine, and *a a* the chains by which it is connected to a purchase at each end, such as separately represented in fig. 2.

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* Reduced from an original set of engravings, on a large scale, published for Lord De Eresby, by Ridgway.

Fig. 3.

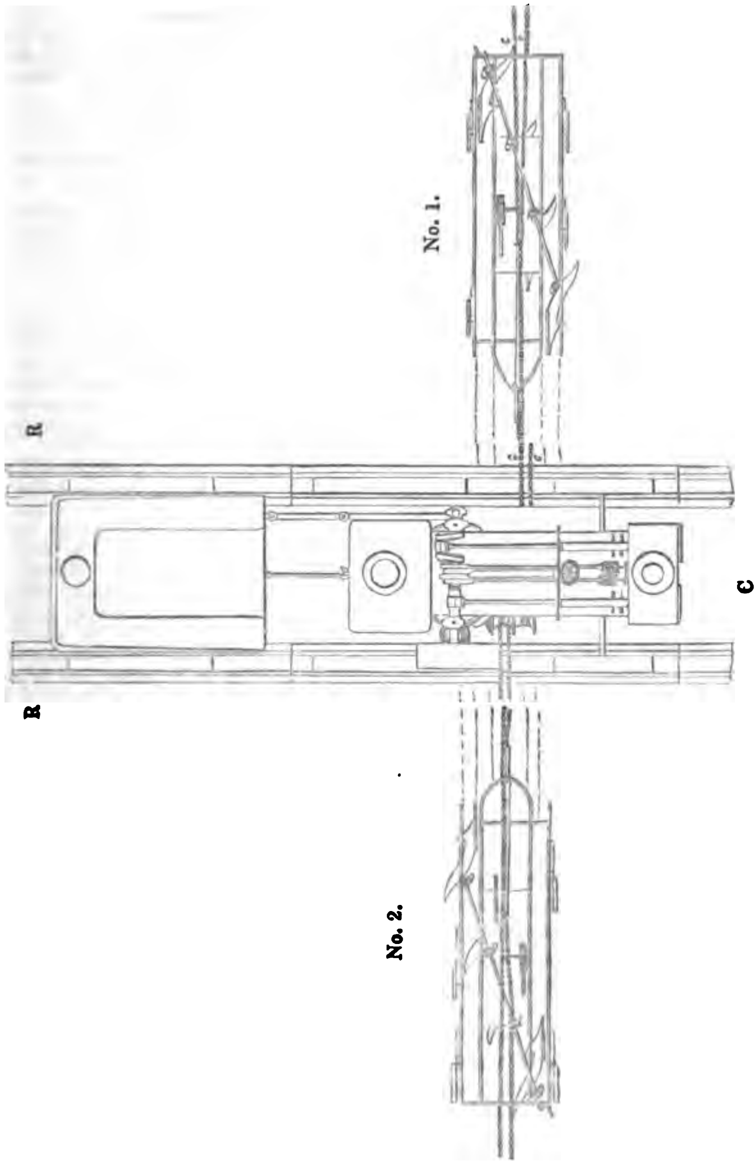


Fig. 3 exhibits a plan or bird's-eye view of the "California" engine at work. C is the engine; R R the portable railway; No. 1, No. 2, the two ploughs, one at each side, No. 1 being a right hand, and No. 2 a left-hand plough; and *c c* is the double or endless chain, by which the engine is connected to the ploughs.

Fig. 4 is a view of one of the side frames (D D), which carry the rollers, round which the endless chain *c c* is wound. E is the anchor by which the side frame is moved forward at each shift.

PROFESSOR YOUNG'S LETTER TO LORD CLARENDON.

This letter will form an important document in the history of mathematical science in the British Isles at the middle of the nineteenth century. It furnishes to the English statesman matter for grave reflection, when "justice to Ireland" is brought before him: for it unveils the hideous moral leprosy with which that unhappy land is afflicted more graphically than any work yet published, even with that express intention. It is the more striking under this aspect, as the picture is incidentally drawn, and totally irrespective of any political or party purpose.

An eminent political theorist, about two centuries ago, thus writes respecting Ireland (under the name of Panopea):*

"Panopea, the soft mother of a slothful and pusillanimous people, is a neighbour Island, anciently subdued by the Arms of *Oceana;* since almost depopulated for shaking the yoke, and at length replanted with a new race. But (through what virtues of the soil, or vice of the air, so ever it be,) *they seem still to degenerate.* Wherefore, *etc.*"

The province of Ulster has been the favorite one with our English anti-papal faction from time immemorial—solely because, in some shape or other, Protestantism is its prevalent religious creed. Compared with the other provinces, too, there has been here a greater development of the industrial resources of the island; and possibly, too, there has been (though this is yet somewhat questionable) a smaller amount of agrarian outrage, both in the shape of incendiarism and murder. These circumstances have led the English Government, one administration after another, to look to Ulster as the one hopeful spot for the *commencement of Irish civilization.* Ulster has been petted and bribed in every possible way; her people, and especially her people's leaders, the several orders of the priesthood, have been at once granted every demand, however exorbitant, or however preposterous. The best "profession" in Ulster is the profession of Presbyterianism; and the best opening in life for a young man of ready wit and Hibernian volubility is the opening of the door of a Presbyterian pulpit. These political considerations are somewhat foreign to our immediate object: but we cannot forbear quoting one specimen of the *impudence* of Irish Presbytery—to say nothing of the utter want of principle in the entire body in its metropolitan city itself.

"But a few days before Sir Robert Peel left office, a Deputation from the General Assembly was despatched from Belfast, to communicate to the Minister the wishes of that reverend body respecting some church matters;—I think about the erection of Manses, but I am not quite sure. This deputation was headed by the Moderator of the General Assembly, the Reverend Dr. Brown; and the Reverend Dr. Edgar was one of the deputies. Shortly after the return of the mission, a meeting of the General Assembly took place in Belfast, and there, in the face of the Assembly and of a very crowded house, Dr. Brown stood up and publicly declared, that he utterly renounced and repudiated all participation in the proceedings of Dr. Edgar and his party with the Premier; that Dr. Edgar without any communication with his leader, and without his knowledge, had forestalled him (Dr. Brown) in his interview with the Premier; and that when Dr. Brown afterwards came in, he found to his utter amazement that he was too late,—that a subject wholly foreign to their message had been introduced —and that Dr. Edgar had been applying for a Government endowment of a Theological College, for the erection of which he had said 20,000*l.* had been bequeathed by a Mrs. Magee! Dr. Brown was just in time to learn that the Government support had been promised, 'and,' said Dr. Brown 'to hear the Premier ask the Reverend Dr. Edgar how much money they wanted.' The Reverend Dr. Edgar modestly replied, 'about 2,000*l.* a year.' 'Sir Robert Peel,' said the Moderator, 'looked significantly at Sir James Graham, who was sitting by his side, and *smiled;*' but the request was granted. Dr. Brown acknowledged that he was dumb-founded by these unexpected proceedings, but as soon as he recovered, he instantly quitted his colleagues in disgust, hastened home by himself, and left Dr. Edgar to stay or follow as he pleased. All this seemed very amusing to the majority of the Assembly; they had got 2,000*l.*

* See "Notes and Queries," No. 42, p. 109.

a year, and Dr. Edgar was forgiven: indeed, they seemed to consider his stratagem as a good stroke of generalship, and Dr. Brown's squeamish honesty excited no little surprise and ridicule.

"Now, no one better than the Reverend Dr. Edgar knew, that although Mrs. Magee had really left the above sum as stated, yet that no College would rise out of it. The old lady was scarcely in her grave when they quarrelled about the intention of her will, the money was thrown into Chancery, and the College will probably be built—when they get it out: they have no college at all up to the present day; but they have a goodly staff of 'Sacred Professors,' and they regularly receive the money.

"The disposal of this unexpected treasure puzzled the ingenuity of the Belfast doctors for a long time; there was meeting after meeting, and conference after conference. The Professors of the proposed Queen's Colleges were to have only 250*l.* a year each, and these were to be *real* Colleges, constructed of tangible brick and stone: it would naturally provoke discontent, perhaps excite inquiry, if the Professors of *their* College, 'the baseless fabric of a vision,' were to be more substantially endowed; and yet how could they cut up theology into eight separate compartments, and affix to each a distinct label? But necessity is the mother of invention, and they overcame the difficulty as follows; as will appear by a reference to McComb's Presbyterian Almanack.

Professors in the Sacred College of Belfast.

Sacred Rhetoric	.. Rev. Dr. Cooke	£250
Christian Ethics	.. Rev. Mr. Gibson	250
Sacred Greek......	Mr. Masson ..	250
Sacred History	Rev. Dr. Killen	250
Sacred Criticism ..	Rev. Mr. Wilson	250
Hebrew	Rev. Dr. Murphy	250
Divinity..........	Rev. Dr. Edgar .	250
Divinity..........	Rev. Dr. Hanna .	250
		£2000

"You see, my Lord, it could not after all be managed without appointing *two* Professors to *one chair*; the first session Dr. Hanna attended about six times; the second, not so often; the third, he spent wholly in London: the fourth, I know not where. The places where the students assemble are the meeting-houses and school-rooms about the neighbourhood.

"The mode in which these gentlemen were elected,—appointed, I mean,—was somewhat novel and amusing: the business commenced with Dr. Murphy's application for the Sacred Greek; but with great propriety, Dr. Cooke interrupted the proceedings, by proposing that they should first ask for 'Divine Direction.' This, of course, was immediately acquiesced in; and as soon as Dr. Cooke had concluded his petition, he uttered 'a deliverance' that Dr. Murphy was not to have the Sacred Greek, but the Hebrew, as he had got another man for the Sacred Greek. And Dr. Murphy did have the Hebrew, and the other man did have the Sacred Greek, accordingly. As each chair brought with it 250*l.*, of course it mattered but little which any one took. All this, too, is recorded in the public newspapers."

Surely Messrs. Hume, Cobden, Bright, and Williams, will direct the attention of the House to these enormities; and Sir Robert Inglis and his party will as surely express strong views respecting a system that deserves no less decided a name than arrant swindling! The toil-worn millions of England must not be "fleeced" to maintain the grandee-priesthood of Ireland—albeit they adopt the name of Protestants, and recognise John Knox as their apostle.

This letter is an appeal to the Lord Lieutenant of Ireland for "justice to an Englishman," who seventeen years ago was entrapped into taking a post in the Royal College of Belfast. Concerning Mr. Young's eminence in the mathematical world, *our readers* do not need to be informed; for our own pages have been frequently graced by his productions, and his name is familiar as a household word wherever mathematical science is cultivated—not only in England, Scotland, and Ireland, but in our Colonies and the United States, and indeed wherever the English language is spoken. His original researches and his didactic works alike render his name illustrious.

Yet this is the man who has to make an appeal to the *British Government* for the miserable stipend to which he is entitled for his long, faithful, and efficient toil in the service of the Government itself! Not only is he superseded (by what agency we shall see presently), but even the agreement entered into with him in its pecuniary sense has also been broken. The minister can give 12,000*l.* a year to the grandson of a king, lavish upon parks and palaces tens and twenties of thousands per annum, and demand of Parliament the elements of an establishment for a child eight years old:—yet when

a man of science presents a just claim, and produces the agreement under which that claim is made, the decision is deferred, pooh-poohed—evaded—in the spirit of the most practised petty-fogger of the time!

Such was the state of things when this letter was published, a few weeks ago; but since then, as if to more deeply sink himself in the eyes of all honourable men, the minister has *compounded* for the claim by allowing *two-thirds* of it!

And what do our readers think is the ground of this abstraction of a third part of the Professor's claim? Simply that he had "*only* served the public *sixteen years*, whilst an old Treasury minute existed which rendered its payment in full imperative only after the service of *seventeen years!*" It signified not that this claimant was one of the most eminent men of his time—not only an ornament, but a benefactor to science and his country,—not only eminent as an original investigator and an elegant writer, but eminently successful as a preceptor, and beloved and venerated by his pupils. These efforts, too, were expended on Ireland—the spot which was the peculiar object of anxiety to every minister who has swayed the destinies of the British empire.

"Why," it will be asked, "then, was this eminent individual superseded?"—"Was he irregular in his moral conduct?—factious in his intercourse with his colleagues or neighbours?—a partizan of some obnoxious creed, or the disseminator of noxious social, moral, political, or anti-religious dogmas?"

No—he was none of these. But it will be better to let Professor Young speak for himself on this point*:—

"During my stay in Belfast, I had but a very limited range of acquaintance; to my students I was well and intimately known, and through them must have been known to the different religious bodies of the North of Ireland in all the particulars respecting which they cared to know me; and I have never heard a single whisper of dissatisfaction on the part of any of those bodies against any portion of my conduct up to the present moment. I was always scrupulously cautious in avoiding offence, or of committing any aggression against the pious poejudices of Belfast Puritanism. I never once, during the whole sixteen years, entered a theatre, or any other place of public entertainment. I and my family led a secluded, and, I thought, a harmless life. Society we had none, for I was not a party-man; and it is *impossible* for a person in my position, in the north of Ireland, to make many friends, without connecting himself with a *party*. He must be either 'New Light,' or 'Old Light,' or 'No Light at all.' He must either condemn the 'Bible-burking Board,' as Dr. Cooke used to call it, or denounce the 'Church-Education-Society;' defend Orangeism, or oppose Episcopacy; canonise John Knox, and spit upon the memory of the Martyr Charles—as the regicide rabble did upon his sacred person, or repudiate Presbyterianism. Suddenly thrown as I was from the heart of London, and its steady-going and stolid inhabitants, among a community of priests, rampant with sectarian excitement, and powerful in platform piety, where every one was ready to do battle for his creed—or rather against that of others, I found myself in the midst of such a bewildering conflict of *isms*, that my only safe position seemed to be that of complete neutrality: this position I adopted and continued to maintain to the end. I never attended an Anti-National-Board Meeting, I never attended a Church-Education-Society Meeting, I never attended an Orange-Meeting, I never attended a Repeal Meeting. From all these controversial gatherings I kept aloof. In matters of religious faith, I always entertained the opinion, that every one was bound by his own conscientious convictions, and not by mine,—an opinion which I at length found was but ill-suited to the moral atmosphere of Belfast. I ought to have made the discovery earlier: and if any religious friend had only awakened me to my fatal delusion, upon my first settling in the country, and in Christian kindness had only explained to me the 'great gain' of Belfast 'godliness,' I might have remained to this day, undefrauded of my income, and have indulged a reasonable expectation of eventually becoming as pious, and, conse-

* We have heard that it was stated in a large party at the house of one of the most eminent and liberal professors in one of our universities, that "Mr. Young was a *Socinian*, and rejected on that ground." Not only was a direct falsehood thus disseminated, but disseminated in the most odious form. We suppose, however, that the malignant traducer had picked up the word in his "Ecclesiastical History Studies," and somehow or other vaguely surmised that Unitarianism (of which he evidently intended to speak, and which is even more obnoxious to the Presbyterians than the papacy itself) adopted the views of Socinus. The most ignorant religionist is always the most malignant.

quently, as well to do in the world, as even Dr. Cooke himself.

"My Lord, it is necessary to the complete vindication of my own injured character, that I should trouble your Excellency with these preliminaries: that I should show the difficulties which surrounded the position in which I was placed, in order that your Excellency may judge whether or not I steered my course among them with ordinary prudence and discretion. It is further necessary that I should now furnish your Excellency with some samples of the spiritual despotism exercised over the place with which I was more immediately connected, a despotism which destroyed my colleagues one after another, but which left unscathed for the long period of sixteen years."

"Why, then—why?" He had had the misfortune to come into collision with the Treasurer of the Belfast College, on the ground of constant arrears in the payment of his salary. He also had the misfortune to come into collision with the Reverend Doctors Cooke and Edgar, the two leading Presbyterian clergymen in Belfast, on the ground of *personal wrong done to his own son.* Of Dr. Edgar the reader has already seen something, and will not be surprised at what may follow. It was a further misfortune to Professor Young, that Dr. Edgar was in league with the notorious George Mathews, subsequently known as the "Castle Defaulter," but more correctly (*Times*, July 26) by epithets that are infinitely more odious in English estimation than this high-flown term—a term apparently invented for the purpose of throwing the grace of respectability over the most enormous robberies. However, it will be more satisfactory to allow Mr. Young to tell this history in his own way:—

"Now, my Lord, during the whole time I was in Belfast there was always a very close and somewhat mysterious connection between the Reverend Dr. Edgar and this same Mr. George Mathews: those in Dr. Edgar's confidence could readily obtain from that reverend gentleman information respecting the plans and intentions of the Irish Government, in reference to local, especially educational interests, long before they were made public. In the case of the vacancy, for instance, in the Belfast Institution, occasioned by Dr. Cairn's death, before adverted to, Dr. Edgar knew the determination of Government, as to whether that vacancy should be supplied or not, long before it was communicated to the managers of the establishment, who had applied to your Excellency for guidance in the matter. I knew it a week, at least, before they did. All my own letters to the Castle, complaining of the non-payment of my salary, were also familiar things to Dr. Edgar: he would comment on particular passages, and give me the benefit of Mr. George Mathews's opinion on particular points. He knew, likewise, the names of the successful applicants for chairs in the Queen's College, long before they were publicly announced; several of these were mentioned to me by one gentleman whom he had enlightened on the subject, at least a fortnight before, and the information proved correct."

And again—

"Within two or three days of my forwarding this letter to the Castle, Dr. Edgar met me: he repeated to me the whole; and evidently proved himself to be in possession of a transcript of my private letter to the Viceroy; at the same time telling me, in a tone of anger, that I had done myself an injury; and concluded with these very words: 'Had Thomson been appointed, it was *our* intention to procure for *you*, through my friend George Mathews, the Vice-Presidency of Cork."

The fact is, that Dr. Edgar wanted the post for his friend Thomson; and for this sordid reason did he manœuvre Mr. Young out of the appointment.

With respect to the Reverend Dr. Cooper, there is a story too long to be extracted here, which will be read with deep interest by every one in whose breast party zealotry has not extinguished the last faint trace of human sympathy, and in whose soul every particle of honourable and honest feeling is not extinguished.

If any one of our English readers should be under the slightest temptation to take a post under Irish management, scientific or otherwise, we emphatically warn them to pause. We urge them to read and carefully consider this sad story of broken engagements—indeed, one of the most striking instances of *bad faith* that we have ever met with. It could have occurred nowhere else than Ireland; and, indeed, we would hope it is an isolated case even there. That the British Government should lend itself to

aid the machinations of such men, is almost beyond belief; but the truth of the statements here put forth are not only undenied, but the practices boldly defended in all their enormity—"for the good of the Protestant cause!"

We have too high an opinion of *our own* countrymen to believe that such practices will not receive the most indignant denunciation from men of all parties and men of no party.

Mr. Young, we are glad to hear, endures this calamitous wrong with a magnanimity worthy of himself. Our sympathies, and the sympathies of all true-hearted Englishmen, go with him; and though dishonourable subtlety may triumph over him for a time, we have that full confidence in the good feeling of a British public, and in the ultimate dispensations of a Divine Providence, which leads us to anticipate a more favourable termination to these persecutions than at the outset would have appeared probable. In the language of old chivalry, we exclaim—"God defend the right!"

ON THE APPLICATION OF ELECTRICITY AND HEAT AS MOVING POWERS.—BY MR. W. PETRIE.

[Abstract of Paper read to the British Association.]

The dynamic value of a current of voltaic electricity is represented by the product of the rate at which electro-chemical action is taking place at any cross section of the current (in other words, the quantity of the current,) and the electromotive force with which the current is sustained, which may be briefly termed its energy or intensity (provided the idea of quantity be kept distinct from this). The first object was to secure such units of comparison for both these elements as should be at all times recoverable. This is given in respect of quantity by the rate of chemical action, and the atomic weights. In respect of intensity of the current, we have no such fixed data, and the intensity of most voltaic arrangements cannot be relied on as constants for comparison. But the elements of Daniell's Battery, and those of nitric acid batteries with negative surface of platinum, carbon, or cast-iron, give an electromotive force or intensity that can be recovered with considerable exactitude, if uniformity of circumstances, materials, &c., be tolerably attended to: these, therefore, may be used to give a fixed and recoverable point in a galvanometric scale of intensity. Now it so happens, that if we assume the degrees of the scale to be of such a size that the intensity of Daniell's (standard) elements shall be 60 of the degrees, temperature being 70 Fahr.—that of nitric acid batteries will be from 100 to 112 of the same degrees: the author, therefore, has always used this scale, to which all other voltaic arrangements can be referred. And this scale, he would suggest, would be most conveniently used in assigning the electromotive power of electric currents from any source. The mean result of careful experiments, tried directly and conversely, is that a voltaic current of one unit in quantity (or that from one grain of zinc electro-oxidized per minute,) and of 100 degrees intensity, represents a dynamic force of 302½ pounds raised 1 foot high per minute.

From this we can infer an important fact, that one horse power is the theoretic or absolute dynamic force possessed by a current of electricity derived from the consumption of 1·56 (one and fifty-six hundreds) pound of zinc, per hour, in a Daniell's battery. But the best electro-magnetic engine that we can hope to see constructed cannot be expected to give more than half or a fourth of this power; in any case we see here the limit of power, which no perfection of apparatus can make it exceed. The peculiar mode in which the electric current produces dynamic effects has led to much miscalculation respecting the power obtainable from it. In any sort of electric engine, the material to which the neighbouring current gives motion, whether it be another moveable current, or, what is more usual, a magnetic body; is impelled in one direction with a constant force, and this force, whether it be attraction, repulsion, or deflection, is, like the power of gravity, sensibly constant at all velocities, however fast the body recedes before the action of the force; provided only the same quantity (per minute) of electric current be maintained. This is quite different from the action of steam power, in which, the faster the piston moves the greater is the volume of steam per minute that must be supplied to

move it, or else the less will be the power with which it moves. This fact, then—that the force with which an electric current of a given "quantity" moves the machine is the same at any velocity of motion—bears no analogy to the case of steam, but would indicate that the dynamic result obtainable from a given electric current might be infinitely great; and so it would be, were it not that the part moved always tends to induce a current in the wire in the reversed direction; and this inducing influence, which increases with the velocity of motion, conflicts with the original current, and reduces its quantity, and consequently reduces the power of the motion, as well as the consumption of materials in the battery. Some have imagined that possible alterations in the position of the parts of the machine, or in its mode of action, would avoid the evil, or even might make the induced current to flow with the primary current instead of against it; the impossibility of this, though not readily proved in detail, can be at once proved by reference to general principles. It would, if true, be a creation of dynamic force; the evolving an unlimited force from a limited source. The tendency to an opposing induced current in the primary wire must, therefore, be involved in the very principle of the system; so that no ingenuity can ever get rid of the retarding influence of the induced action; and the only way to overcome its power, so as to maintain the primary current from falling below a given rate or quantity, when the machine is allowed to attain rapid motion, is to increase the electro-motive power of the battery, the intensity (not the quantity) of the current, so that it shall be less affected by the opposing induction.

The practical importance of these truths may justify the above somewhat particular notice of them. For want of a clearer apprehension of them, inventors have misapprehended the direction in which improvements were to be made, and much ingenuity and means have been wasted. Some of the best electro-magnetic engines that have been properly tested by the author and others on a practically useful scale, have only given a power at the rate of 50 to 60 lbs. of zinc per horse power per hour. The smallness of this power in comparison with the absolute value of the current (1·56 pound zinc per horse power per hour), should not occasion surprise if we consider the present case of steam after many years of improvement. According to the determinations of Joule and of Rankine on heat, 1 lb. of water raised 1° of temperature is equivalent to 700 lbs. weight raised 1 foot. The author thence proceeded to show that the best Cornish engines only yield one-fourteenth of the power that the combustion of the carbon actually represents, and many locomotives only one-hundredth part;—showing what great rewards may yet await the exercise of inventive genius in this department, and that we need not wonder that we have as yet only obtained one thirty-second part of the power possessed by electricity. But it is to be remembered that there is a far greater likelihood of obtaining a larger proportion of the real power from electricity than from heat, owing to the character of the two agents. The author then proceeded to explain the reasons why so little of the power of heat could be obtained in a useful form even in the best steam engines, and what were the difficulties for invention first to overcome in order to a better result. In the case of electricity, however, there is no analogous difficulty; but we have, instead, the difficulty and expense of developing current electricity by the chemical actions now requisite. If carbon could be burnt or oxidized by the air, directly or indirectly, so as to produce electricity instead of heat, 1 lb. of it would go as far as 9½ lbs. of zinc (in a Daniell's battery), chiefly because there are as many atoms in 1 lb. of carbon as there are in 5½ lbs. of zinc, and partly because the affinity (for oxygen) of each atom of (incandescent) carbon is greater than that of an atom of (cold) zinc, minus the affinity of the hydrogen for the oxygen in the water of the battery. Apart, however, from such prospects of improved means of obtaining electricity, its favourable feature, on the other hand, in comparison with heat, is the reasonable expectation that we may obtain from electricity a considerable portion of the power which the author has determined as being the dynamic equivalent of the electric current.*

* For an account of Professor Page's experiments in the same direction, see a subsequent article, p. 196.

HOWSON'S DIFFERENTIAL SCREWING APPARATUS.

[Registered under the Act for the Protection of Articles of Utility. Messrs. Richard and Henry Howson, Manchester, Proprietors.]

The differential screwing mechanism which forms the subject of this registration, is applicable chiefly, if not solely, to presses; but within that range of application it offers some very decided advantages. The accompanying engravings exemplify its adaptation to letter-copying presses.

Fig. 1.

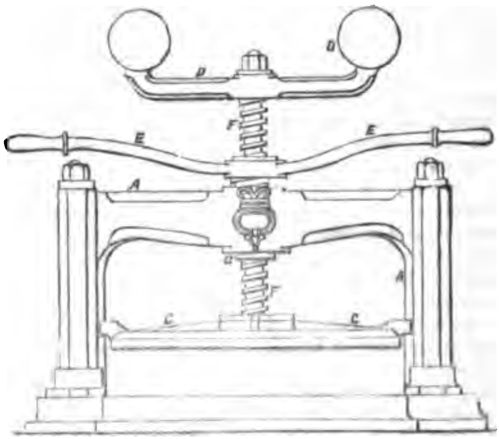


Fig. 2.

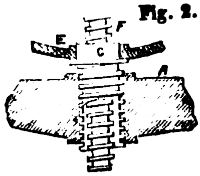
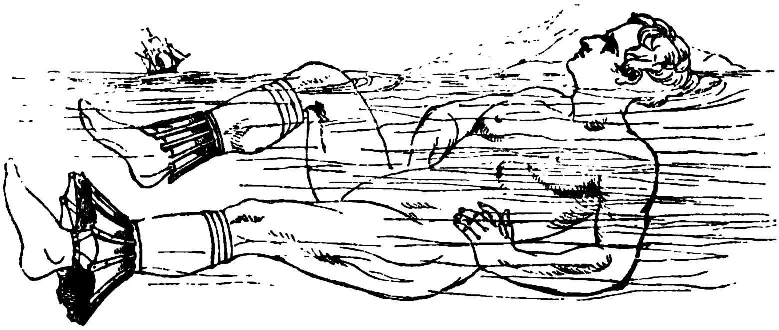


Fig. 1 is a front view, and fig. 2 a partial section of the press. Into the cross-beam A of the press is screwed the nut C, having a handle E, and through this nut passes the screw F, the upper end of which is furnished with the weighted handle D; the lower end has a rounded head or button of larger diameter than is usually employed, which works in a socket on the top plate *c* of the press. The threads of the screwed nut G, and those of the screw F differ in the distance of their pitch. It is this difference which gives the power to the press. The operation is as follows:—By applying a slight force to the handle D, the plate *c* is brought upwards to the height required for the admission of the material to be pressed; it is then turned in a contrary direction until the top plate touches and slightly presses against the object underneath. The screwed nut G is now brought into operation; the handle E to which it is secured being turned, a great force is exerted on the plate *c* at the expense of but a small amount of manual labour. During the operation of the handle E, the screw F is prevented from turning round by the friction of its enlarged button in the socket of the plate *c*. As the power is gained not by fineness of thread, but by the difference in pitch of the two threads, it is evident that the screw F may be made much coarser in pitch than those of ordinary presses, and yet speed in the ascent and descent of the plate *c* be thereby obtained. It will also be seen that the power may be increased to an extent proportionate to the nearness of pitch, to which the two screws are made to approximate.

OBSERVATIONS UPON SWIMMING, WITH A DESCRIPTION OF COX'S PATENT SWIMMING STOCKINGS. BY MR. COX.



It is a melancholy fact that, of recent date, there have been several shipwrecks even in calm summer weather, within a few hundred yards of the shore.

How to render aid, and ensure a greater amount of safety, cannot fail to be interesting to all.

Notwithstanding the many disasters consequent upon carelessness and ignorance which have already been so distressing, it is much to be feared the sad experience of the past will not guarantee perfect management for the future. That there are many shipwrecks purely accidental, and beyond all calculation and control of man, is a truth which cannot be doubted; and to Providence, therefore, in such cases, all should be resigned. It is, however, in the power of almost every one to provide in some measure against the severity of most accidents, by familiarizing the mind with cases of danger, and studying and practising means of escape and prevention. By familiarizing the mind with circumstances of danger, there will be much more chance of coolness and presence of mind being manifested, and evil averted when calamity overtakes, than when the mind is unenlightened and void of resources and experience.

From the maritime traffic and intercourse of our country, and the dangers of navigation, it certainly ought to form an important part of the education of youth to learn to swim, and become familiar with the motion of the body in the great liquid element. Man, however, from his structure, is not calculated for powerful or prolonged swimming. Having neither fins nor webbed feet, he can exert little of his muscular strength in propulsion of the body, and he soon becomes exhausted from the difficulty of sustaining the motion of the legs and arms in the water. The muscles of the legs being more powerful than those of the arms, it is evident that if the power of the former can be brought principally into effective operation, much longer continuous swimming will result.

The action of the legs and feet alone, although to some extent effective, cannot propel the body easily through the water, as the action and re-action, or the propelling and retarding powers, differ only to a small amount. If the pushing out of the legs (or swimming stroke) be estimated at a power of 10, the drawing up again, preparatory for a new stroke, may be said to represent a retarding power of 6, and thus out of a total power of 16 exerted, only 4 (the difference between the propelling and retarding forces) is available for propulsion, the other 12 parts going merely to exhaust the swimmer. But further, when the foot is forced against the water, the water is pushed much more from the body than the body from it—or in engineering phrase, the "slip" is great, owing to the narrow compass of the foot, which does not expose sufficient breadth of surface to take firm hold of the water. It may be also remarked, that the human body being nearly of the same specific gravity as water, unless a person in the water have the assistance

of some floating substance, a considerable part of his strength gets exhausted from the mere effort to keep his head above water. In all cases, therefore, it is of great importance to possess one of M'Intosh's air-bags or some other buoyant body, to affix round the waist, thus allowing all the muscular energies to be expended in propulsion alone.

When a shipwreck takes place, the first consideration should be that of *position*. If the distance from shore is so great as to render it altogether impossible for a person to swim ashore, then he ought to keep on *all his clothes*, that the heat of the body may be longer maintained, and the vital functions prevented from becoming soon benumbed, thereby giving a better chance of being picked up alive by a boat from the shore or passing ship. When the shipwreck is near the shore, and the party is to avail himself of the floating bag and propelling apparatus I shall presently describe, he ought to be divested of his coat (although he may keep it on) and the legs of his trousers, so as to allow free motion of his own legs.

The object of this apparatus is to enable a person, in case of emergency, to swim or propel himself through the water with the facility of the swan, duck, or other aquatic webbed feet birds or animals, and thereby to possess the means of saving not only his own life, but the lives of others. In cases of shipwreck it frequently happens that the lives of all on board might be saved if any communication with the shore could be established; but, in a rough sea, the small propelling effect afforded by the narrow surface of the human foot, seldom suffices to enable even an experienced swimmer to reach the shore. Hitherto, the only effectual means of communicating with a wreck in a stormy sea, have been by Captain Manby's apparatus for throwing a light rope on board, or by life-boats, but these are rarely at hand when wanted, and generally many miles from the scene of shipwreck.

The swimming stockings present various advantages, being light, portable, easy of application, and can even be worn on the legs without incumbrance, and thus be ready for use in the moment of need.

But it is not in cases of shipwreck only that the invention is applicable. In many other situations it may become the means of saving life; and, at bathing-places, it may be most advantageously used as a means of healthy and invigorating exercise. Aided by the apparatus, an ordinary swimmer can move through the water with a facility and freedom which add greatly to his enjoyment; while, with the aid of a floating bag, a person who cannot swim at all may be rendered comparatively independent and enabled to escape from a wreck and reach the shore, where otherwise he might be drifted away by the wind and tide.

The swimming apparatus consists of a circular piece of suitable cloth, sewed strongly round the leg of a stocking, and kept in a proper position for expanding and contracting by mean of cords and wooden ribs; it resembles, in fact, a small umbrella round the leg, expanding when pushed against the water, and closing when drawn in an opposite direction. In using it the stockings are to be drawn on the legs quietly and tightly, and fastened with an elastic garter below the knee, to prevent them from slipping down.

To make the most rapid progress through the water, the best position is on the back. The swimmer ought to draw well up, and strike smartly out, each leg *alternately*, in the line of motion of the body, for by doing so a more continuous and uniform motion is kept up than when both legs are drawn up and struck out together. The leg ought to be held steady for an instant after being drawn up, as the rush of water after it, assists the expansion of the apparatus previous to taking the out stroke, which consequently is more effective from the "slip" being less. For a *prolonged swim*, an average of from fifty to sixty strokes per minute will be found very suitable in point of speed and economy of strength; but a little experience on the part of the swimmer will soon make him acquainted with the best ways of using the stockings. The expansion of the cloth round the stocking will occupy a diameter of from 12 to 16 inches, which affords about a square foot of propelling surface. With a pair of these stockings a person may swim in summer weather a mile for pleasure, and several miles if for his life.

On Thursday, August 15, a person

swam across the Frith of Forth, at Queensferry, accomplishing the distance of nearly two miles in 50 minutes, and without fatigue.

JOHN COX.

Gorgie Mills, Edrie, August 19, 1850.

MATHEMATICAL PERIODICALS.

XXII. *Miscellanea Curiosa Mathematica.*

(Concluded from page 154.)

Art. LIV.—On the Curve which a Projectile describes in a Uniform Medium, that resisteth in any multiplicate ratio of its Velocities.

Art. LV.—A short Essay on the Sail and Rudder of a Ship. By Mr. Benjamin Donn.

Art. LVI.—The Elements of the motion of the Comet of 1743-4. By the Rev. Stephen Bolton.

Art. LVII.—Conclusion of the Method for finding Fluents from Mr. Emerson's Table. By F. Holliday.

*** At the conclusion of this paper the writer takes occasion to tell Waltoniensis (Mr. Landen), "that it is plain he did not understand what he was writing about," when he objected, in pp. 102-3, *Turner's Exercises*, to Mr. Emerson's treatment of Fluxional Equations; and by way of amendment, offers several corrections of Mr. Landen's results. These emendations, however, consist in nothing more than the substitution of $+$ where Waltoniensis only writes $-$, agreeably to the nature of the Problem under discussion. Both Mr. Holliday and "an ingenious correspondent, Amicus," agree that Mr. Landen's "objections proceed only from his ignorance of the subject, or the prejudice of party;" and consider it "a pity that an ingenious person should censure an Author of reputation without any reason, and expose his own judgment merely for the sake of party, and have no other way of raising his merit than by detracting from that of others." In the same paper, however, they *excuse* Mr. Emerson's *mistake* by observing, that "he does not propose to give the *correct* fluent in that proposition, but in a proposition afterwards!" The discontinuance of both the *Miscellanea* and the *Exercises* would prevent any reply from Waltoniensis, if indeed such were necessary; for although he may have been subject to the frailties of human nature in several particulars, there does not appear sufficient reason for the imputations contained in the preceding extracts. The controversy between Heath and Simpson was engrossing considerable attention at this period, and it is not to be wondered at, if so decided an Emersonian as Holliday should feel himself somewhat aggrieved by the freedom with which the oversights of his favourite were handled by some of the disputants.

Art. LVIII.—Two Problems in Summation of Series. By F. Holliday.

*** It will be evident from the preceding list that pure Geometry engaged but a small share of the attention of mathematicians at this time; some three or four of the articles being all that make any approach to a geometrical character. On the contrary, Newton's *Principia*, *Physical Astronomy*, and the *Applications of the Fluxional Calculus*, were cultivated with considerable ardour by the correspondents of the *Miscellanea*, which, on this account, must have rendered much assistance to students in their analytical researches. The conductor, too, was an ardent admirer of Emerson and his writings, and from the fact of *both* being very extensive contributors, the main features of the work have much in common with the earlier publications of that somewhat peculiar Author.

Questions. — The total number of mathematical questions in both volumes of this periodical is 208, of which 195 received solutions. Of these 2 belong to Chances, 3 to Arithmetic, 3 to Series, 10 to Geometry, 18 to Astronomy, 11 to Mechanics, 27 to Algebra, 30 to Plane and Spherical Trigonometry, 29 to the Application of Algebra to Geometry, Mensuration, &c., and 62 to the Doctrine of Fluxions and its Applications. The collection of Problems at the end of Emerson's *Algebra* may be referred to as making the nearest approach to a *fac-simile* of this department of the *Miscellanea;* for although notation had been much improved by various writers when the *Algebra* was published (1764), Mr. Emerson was not the person to lay aside established usage, and adopt any such "new-fangled fooleries" as improved notation and modernized methods of treating mathematical subjects.

Ques. 8 is proposed by Hurlothrumbo

(Simpson), and gives the difference of azimuths of three known stars at the same time to find their altitudes and the latitude of the place. It had been wrong printed in the *Gentleman's Magazine* for June 1738, and was here solved by Philofluentimecanalgegeomastrolongo (Emerson).

Ques. 14 gives a point A in a rectangular billiard-table, and requires to strike a ball of a given diameter, so that after *three* reflections it shall pass through the same point A. From the frequency with which cases of this inquiry have been proposed, it would appear to have been a favourite speculation with geometrical students. Various forms of the problem may be met with in the *Diaries*, the *Mathematician*, the *Math. Companion*, &c.; and it may be added, that not only the usual forms, but their converses and extension to the ellipse are very elegantly treated in the MS. remains of that distinguished geometer, the late J. H. Swale, of Liverpool.

Ques. 20 is another by Hurlothrumbo, which is again answered by Emerson under his extraordinary signature. It inquires "what form a mass of homogeneous matter must take, that the attraction thereof on a corpuscle, somewhere in or without its surface, may be the greatest possible. Also what is the ratio of this attraction to the greatest whereby the corpuscle can be affected, when the same matter is in the form of a sphere."

Ques. 28 investigates "a general theorem for the convex superficies of the ungula made by a plane cutting a cone parallel to its side:" it was proposed by Mr. N. Oates, and answered by Emerson (Philo., &c.) and Mr. William Brown.

Ques. 29 is proposed by Mr. Holliday, and requires "a point within a triangle, such that the sum of its distances from the angular points may be a minimum."

The question appears to have been first proposed by Fermat to Torricelli, who re-proposed it to Viviani in a form very similar to the preceding. Vieta paid some attention to it in his *Opera Math.*, p. 345, and an algebraical solution is given by Newton in Prob. 27 of the *Arith. Universalis*. Professor Simpson gave demonstrations in several places:—in his *Fluxions*, Ex. 12, p. 26, Ed. 1823; *Algebra*, Prob. 58; *Max. and Minima*, Prob. 3; *Appendix to Geometry*, Prob. 31; *Select Exercises*, Prob. 56; most of which are distinguished for his usual elegance. Newton's solution was transferred by Emerson into the Collection of Problems (No. 107) at the end of his *Algebra*, and Viviani's geometrical demonstration has been given, accompanied by an appropriate reference, as Prob. 6, Sect. 3, of Cresswell's *Maximum and Minimum*. The same inquiry also forms Prop. 35, Book iii., of Leslie's *Geometrical Analysis*, and an interesting variation was proposed by Mr. D. T. Sheridan as Ques. 378, No. xxi. of the *Mathematical Companion* for 1818, where it was elegantly treated by "A. B. L." (Miss Lousada) and Mr. John Baines, of Nottingham. Dr. Wallace took up the subject in pp. 111-124 of his *Geometrical Theorems and Analytical Formulæ*, treating most of the principal cases very fully by his method of focal points, and giving at the same time a sketch of its early historical features; he had also previously given a memoir involving similar considerations in vol. vi. of the *Cambridge Phil. Transactions*. It would not be difficult to increase the list of references to a considerable extent, but as they are mostly transcripts from preceding authors, it could serve no useful purpose:—it may, however, be mentioned that Professor Davies has given a beautiful expression for the *sum* of the lines when a minimum, in vol. i. Ex. 36, p. 470, of his edition of *Hutton's Course*, which has been elegantly investigated as Ques. 1697 of the *Lady's and Gentleman's Diary* for 1843.

Ques. 61 gives the sum of the sides, the vertical angle, and the perpendicular, to construct the triangle:—it was proposed by Mr. Thomas Simpson, and answered by Mr. John Turner.

Ques. 84 is proposed by Turner, and gives a triangle in species "to inscribe therein another given triangle, so that the triangle given in species may be a maximum." Solutions by means of fluxions are given by Emerson (*Philo.*, &c.), Jepson, and the proposer.

Ques. 88 relates to the ascent and descent of a projectile in a medium of uniform density, and is said by Mr. Holliday to have been "proposed and

solved by a conceited foreigner (Bernouilli), who is perpetually boasting of his own performances, and at the same time depreciating those of others, especially the English methematicians (against whom he seems to have a particular spite), not excepting Sir Isaac Newton himself;" but it so happened that "the solution, on which he spends no less than twenty pages in quarto—— is wide enough *from the truth*." A simi'ar question had been proposed in the *Gentleman's Magazine* by Mr. Landen, the solution to which was corrected by Mr. Emerson in his Fluxions; both of which are reprinted in No. 2, of the *Miscellanea*. The subject is again resumed in Ques. 118, when elaborate solutions were given by Holliday and Emerson (Philo., &c.), the former of whom takes occasion to term John Bernouilli a "boasting mathematical Hector," because "he glories exceedingly that he has given a solution shorter and more general than Sir Isaac Newton in his *Principia*."

Ques. 94 relates to the subject of gunnery, and was proposed by Mr. R. Robinson in order that an extensive series of problems respecting projectiles might be demonstrated. He gives the investigation of 24 theorems and 12 problems, to which a "Table of Gunnery" is added by the editor. The subject was again resumed in Ques. 19, vol. ii., by Mr. Benjamin Donn, who added ten problems as a completion of Mr. Robinson's theory. The results are those usually obtained in the theory of projectiles in vacuo.

Ques. 114 is proposed by Gamston Retford (Holliday ?) in order "to determine the quantity of degrees whereby the moon is retarded by the action of the sun, while the earth describes about the sun the least given arc possible;" an elaborate solution is given by H(olliday), which occupies no fewer than nine quarto pages.

Ques. 124 determines the length of a string that will reach round two wheels of given diameters, placed at a given distance from each other.

Ques. 133 investigates the radius of the *maximum* circle in the Arbelon of the ancients:—it was proposed by Mr. John Ash, and answered by Mr. W. Jepson.

Ques. 18, vol. ii., requires the place where an eye must be posited in the line of centres, so as to see *equal* surfaces of the earth and moon:—one case of a problem which has found its way into almost every mathematical periodical, and has been claimed as *new* by more than one individual in recent times.

Ques. 31, vol. ii., is the only problem in the *Miscellanea* to which a *purely* geometrical solution is given, independently of numerical data. It was proposed by "Philopesos," and gives "two triangles ABC, DEF, to inscribe a triangle in ABC that shall be equiangular to DEF." An algebraical solution is given by "Amicus," and geometrical ones by Mr. J. Wigglesworth and the proposer, whose construction and demonstration are so satisfactory that the editor "returns thanks to this gentleman, and should be glad of more problems of this nature, as he seems capable of the arduous tasks in geometry, which sort of problems will be useful, and giv ethe reader a clear and perfect idea of the method of demonstration." Such remarks from the editor of a mathemaical periodical of considerable circulation, afford a curious proof of the low ebb to which the study of the ancient geometry had subsided, previously to its revival under Simpson and his immediate successors.

Contributors.—Messrs. Arwin, Bamfield, Bevil, Bolton, Brown, Bulman, Chapple, Charlton, Coleridge, Cowper, Crossley, Davies, Dent, Donn, Dunn, Epworth, Farrer, Gregory, Garrard, Hammond, Hart, Hartley, Hauxley, Holliday, Jepson, Kingston, Leonard, Malham, "Morpethiensis," "Oxoniensis," "Philofluentimecanalgegeomastrolongo" (Emerson), Powle, Reed, Robinson, Sharp, Simpson, Smith, Street, Sutton, Todd, Turner, Waine, Ward, Williams, Wigglesworth, Western, Yewland, &c., &c.

Publication.—From the fact that the first volume, comprising *nine* numbers, was not completed before about April, 1749, we are led to infer that, although the publication was announced as *quarterly*, it really took place half-yearly, or at irregular intervals. The last *five* numbers extended over a period of about *four* years; so that this publication was well nigh *yearly*. All the work appears to have been printed "for Edward Cave, at St. John's Gate, London," the well-

known proprietor of the *Gentleman's Magazine.*

THOMAS WILKINSON.

Burnley, Lancashire, Aug. 19, 1850.

Errata.

Vol. 52, p. 446, line 29, col. 2, for *Mitchell*, read *Witchell.*

Vol. 52, p. 447, line 2, col. 1, for *Mitchell*, read *Witchell.*

Vol. 52, p. 448, line 52, col. 1, for *hoops*, read *hoofs.*

PROFESSOR PAGE'S ELECTRO-MAGNETIC MOTIVE ENGINES.

Professor Page, in the lectures which he is now delivering before the Smithsonian Institution, states that there is no longer any doubt of the application of this power as a substitute for steam. He exhibited the most imposing experiments ever witnessed in this branch of science. An immense bar of iron, weighing 160 lbs., was made to spring up by magnetic action, and to move rapidly up and down, dancing like a feather in the air, without any visible support. The force operating upon the bar he stated to average 300 lbs. through ten inches of its motion. He said he could raise this bar 100 feet as readily as ten inches, and he expected no difficulty in doing the same with a bar weighing one ton, or a hundred tons. He could make a pile-driver, or a forge hammer, with great simplicity, and could make an engine with a stroke of 6, 12, 20, or any number of feet. The most beautiful experiment we ever witnessed was the loud sound and brilliant flash from the galvanic spark, when produced near a certain point in his great magnet. Each snap was as loud as a pistol, and when he produced the same spark at a little distance from this point it made no noise at all. This recent discovery is said to have a practical bearing upon the construction of an electro-magnetic engine. Truly a great power is here; and where is the limit to it? He then exhibited his engine of between four and five horses power, operated by a battery contained within a space of three cubic feet. It looked very unlike a magnetic machine. It was a reciprocating engine of two feet stroke, and the whole engine and battery weighed about one ton. When the power was thrown on by the motion of a lever, the engine started off magnificently, making 114 strokes per minute; though, when it drove a circular saw, 10 inches in diameter, sawing up boards an inch and a quarter thick into laths, the engine made but about 80 strokes per minute. There was great anxiety on the part of the spectators to obtain specimens of these laths to preserve as trophies of this great mechanical triumph. The force operating upon this great cylinder, throughout the whole motion of two feet, was stated to be 600 lbs. when the engine was moving very slowly, but he had not been able to ascertain what the force was when the engine was running at a working speed, though it was considerably less. The most important and interesting point, however, is the expense of the power. Professor Page stated that he had reduced the cost so far that it was less than steam under many and most conditions, though not so low as the cheapest steam engines. With all the imperfections of the engine, the consumption of 3 lbs. of zinc per day would produce one horse power. The larger his engines, contrary to what has been known before, the greater the economy. Professor Page was himself surprised at the result. There were yet practical difficulties to be overcome, the battery has yet to be improved, and it remains yet to try the experiment on a grander scale—to make a power of 100 horses, or more. Truly the age is fraught with wonders, and we can now look forward with certainty to the time when coal will be put to better uses than to burn, scald, and destroy.—*National Intelligencer* (American paper).

THE ELECTRIC TELEGRAPH BETWEEN ENGLAND AND FRANCE. — EXTENSION TO IRELAND AND AMERICA.

The long-promised experimental operations for establishing a telegraphic communication, by means of wires sunk in the Channel between Dover and Calais, commenced at Dover on Tuesday, the 27th August. At one o'clock, the General Shipowner's steamer, *Goliath*, was in readiness, steam up, at Dover Harbour, to start across the Channel, with all the necessary apparatus and machinery on board, and a crew of about thirty men, consisting of pilots and sailors, under the superintendence of Messrs. Jacob Brett; W. Reid; C. J. Wollaston, C.E.; F. Edwards and others. Between the paddle-wheels, in the centre of the vessel, was a gigantic drum, or wheel, nearly 15 feet long and 7 feet in diameter, weighing 7 tons, and fixed on a strong framework. Upon it was coiled up in close convolutions about thirty miles of telegraphic wire encased in a covering of gutta percha half an inch in diameter. The point proposed to be reached, Cape Grinez, the nearest landmark to the English coast, and between Calais and Boulogne, is a distance of 21 miles, so that a surplus supply of nine miles of wire was held in reserve for the purpose of slackening. The intention was to steam out at five miles an hour, to pay out progressively the whole extent of telegraphic

tackle, and to imbed the wire by means of leaden clamps, of which there were some hundreds on board, of 20 lbs. and 25 lbs. weight, in the bottom of the sea. The vessel was provisioned for the day, and Capt. Bullock, of Her Majesty's steam-ship *Widgeon*, caused the tract of the navigation to be marked in as direct a route as possible, by placing a series of pilot buoys with flags on the route, besides being prepared to accompany the experimental cruise with his own vessel as a tender. The connecting wires were placed in readiness at the Government Pier in the harbour, and likewise at the Cape, where they run up the face of the acclivity, which is 124 feet above sea-mark. The necessary batteries and manipulators were all on board, but as a gale and rolling sea unexpectedly sprung up over a previously comparatively calm sea, it was deemed unadvisable by the experimenter to venture out, and the operation was adjourned. Some interesting experiments, however, were made on a small scale, to show the practicability of the plan. A mile of wire was paid out off deck from the pier, to Shakespear's Cliff, and the sinking process was proved to be practicable of performance. A communication to the following effect was also sent through 24 miles of wire:—"Printed by Electric Telegraph, on board the *Goliath* steam-boat." On Wednesday morning, the experiment was renewed with complete success. The *Goliath* started from Dover at half-past 10 o'clock, provisioned for the day, with a crew of about thirty men, and proceeded at a rate of about four miles per hour, preceded by the *Widgeon*, Capt. Bullock, R.N., as pilot, who had caused the track in a direct line to Cape Grinez to be marked by buoys and flags on staves. The wire continuously streamed out; and at every sixteenth of a mile, a leaden clamp or weight, as mentioned above, was securely riveted on, to secure it at the bottom of the sea. Interesting salutations were kept up hourly during the progress of submerging the wire between the gentlemen on board and Mr. John Brett, who printed the first message across the Channel.

The sea at Dover is about 30 feet deep, increasing as the track proceeds to about 30 fathoms, or 180 feet, which is the greatest depth, except in mid-channel, where there is a point called the Ridge, and another the Varn, both shallows, and dreaded by navigators—one 17 miles in length, and the other 12. Between these there is a deep submarine valley, surrounded by shifting sands, in which ships lose their anchors, and fishermen their nets. The wire was, however, safely sunk across these to a depth which, it is hoped, will place it out of the reach of anchors or monsters of the deep. At half-past eight in the evening, the *Goliath* safely arrived on the French side of the Channel; and the other end of the wire was run up the cliff at Cape Grinez to its terminal station. Complimentary messages between England and France immediately took place; and these two countries will now interchange correspondence by a messenger which sets time and detention, wind and storm, at defiance.—*Daily Papers.*

The establishment of an electro-telegraphic communication across the Straits between England and France has been for a considerable time foreseen, as one of the most natural in the train of consequences resulting from the modern application of electricity to the transmission of intelligence between distant parts. If a line of wire could convey the electric impulse for thousands of miles over the surface of the earth—as it has done and is doing—there could be nothing in the nature of things to prevent it from being equally efficacious if carried under the earth or even under water; granted always, what no one has been heard to dispute that it is in the power of art to protect the wire from whatever antagonistic influences it may be exposed to when laid down under earth or water. Trials of submerged lines of wire had, in fact, been made with perfect success across the Thames and the Hudson—both tolerably broad rivers; and it was not to be doubted that what could be accomplished in this way for one mile, could be accomplished for thirty or fifty, or, indeed, any number of miles. It was but, in any case, to make the line of submerged wire longer—to sink it (perhaps) deeper—and (if deeper) to protect it better. The simplest of things, however, when carried out on a large scale require often, as in this instance, for the doing of them, qualities of a high order—great enterprize, great perseverance, great executive powers of construction and direction. It was a great thing, assuredly, to undertake to underlay a sea of some thirty miles wide with one continuous line of communication—a single break or flaw in which would be fatal to the whole; there was the risk of failure to be braved; and in any event much expenditure of money, time, and trouble to be adventured on the issue; and

beyond all doubt or question, it is a great thing to have successfully accomplished. To all such honour as belongs to the performing of a great undertaking well Messrs. Jacob and John Brett, the engineers of the Dover and Calais line of telegraph are richly entitled. The newspapers say that they have obtained "the exclusive right of electric communication between this country and France for ten years." We do not well see how this can be, looking at the legal difficulties in the way; but we are sure that no reward they can have secured to themselves will be too great for the prodigious advantages which they have secured by their individual exertions, not only to both England and France, but to the world at large. For an electric telegraph to Calais, is not a thing which will stop there. It is a telegraph to Vienna, to Moscow, to Constantinople, to Ispahan, to Delhi, to Calcutta,—to the remotest bounds, in short, of Europe and Asia. A few years ago people laughed when Lord Palmerston predicted at the Southampton Meeting of the British Association, that a time might come when on the Minister of the day being asked in Parliament, "Whether it was true that a war had broken out in India?" would reply, "Wait an instant till I telegraph the Governor-General, and I will tell you." What was thought but a good joke in 1843 is now, in 1850, in the course of being actually accomplished; and, ere a few years more, is likely to take its place amongst the sober realities of the age. Nor to the Old World alone need our views of the ultimate progress of electro-telegraphy be confined: for since the English Channel has been crossed, the crossing of the Irish must follow next as but a matter of course; and Ireland once reached, there lies but a couple of thousand miles of water or so between the Old World and the New. We say "but," for after all there is the practical difficulty? Not in producing the length of wire required; for *any length* of wire can be spun—not in covering and insulating the wire; for thousands of miles of wire can be covered and insulated just as readily and surely as one—nor yet in laying it down, as the Dover and Calais experiment has fully shown. The only real difficulty in the case, we apprehend, will be to find ship-room for the enormous coil of wire that would be required; but this is an objection which vanishes before the recollection of such leviathan structures as the *Canada* and *Great Britain*. Besides, means may be found to effect on board the laying-down vessel a perfect junction of different lengths of wire, so as to allow of two, three, or more reels being employed. We assume, of course, that battery power sufficient to transmit the electric impulse through a wire of some two thousand miles long is at our command; but though we are not aware of any recorded experiments that would justify us in taking the possibility of this for granted, we know that the recently invented *receiving magnet* of Morse is founded on the principle of counting for nothing the mere distance to which the electric message has to be transmitted; and, at all events, the fact is one capable of tentative determination on land before a single yard of an Atlantic line need be laid down. The Old and New Worlds being thus united, we should then see the dream of the poet even more than realised; the earth "girdled round" about—not in "forty minutes"—but in a thousandth part of the time—in a single beat of the clock. What would all the other triumphs of human genius be to this? Time and distance literally annihilated throughout the bounds of the planet which we inhabit! A triumph only to be transcended when the planets shall themselves begin to telegraph one another—which is one of the very few things which, in this age of art-miracles, one would venture without hesitation to say will never happen.

INFRINGEMENT OF A REGISTERED INVENTION.

GUILDHALL.—*August* 29, 1850.

J. Welch, *J. S. Margetson*, *G. E. Mitchell*, and *E. Price*, of the firm of Welch, Margetson, and Co., silk mercers, of 17, Cheapside, appeared in answer to an information charging them with unlawfully exposing for sale a portmanteau, the same being a fraudulent imitation of a registered design

after receiving due notice that the consent of Mr. Motte, who owns the design, had not been given for that purpose.

The proceedings commenced about a month ago, when a great deal of evidence on both sides was heard. On behalf of Mr. Motte it was deposed that the plan and construction of the portmanteau were novel, and calculated to effect a great saving to the public, as the article might be made in one-third of the time required for the manufacture of one put together on the old system. On the other side a number of witnesses stated that there was nothing in Mr. Motte's design which could be claimed as absolutely new; and that portmanteaus of a similar kind had been made a great number of years ago in this country and in Ireland.

On Tuesday some further evidence, which was also of a very conflicting nature, was heard.

Alderman Challis said he had given a great deal of time and careful attention to this case, in order that it might not be said that he had decided hastily, and after weighing all the facts before him he could not but arrive at the conclusion that complainant had fully made out his claim for protection. The evidence had only proved that the several parts forming the portmanteau were not each by itself of modern invention. That was very true, but there had been no evidence that the application of all those old inventions in one article of utility, whereby a great saving of expense and time in making was effected, was otherwise than new. Under these circumstances he thought he should only be acting with justice to all parties in giving his judgment in favour of the complainant. But as the complainant stated that he did not ask for the infliction of a heavy fine, but merely a decision, he would fine defendants the sum of 5*l.*, and the costs to be settled by the clerk of the court.

Mr. Clarkson (instructed by Messrs. Robertson and Co.) appeared for the plaintiff, and Mr. Hawkins for the defendants.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING SEPTEMBER 5TH, 1850.

Thomas Richards, William Taylor, and James Wylde, the younger, of the Falcon Works, Walworth, Surrey, cotton manufacturers. *For improved rollers to be used in the manufacture of silk, cotton, woollen, and other fabrics.* Patent dated March 2, 1850.

The patentees remark, that fibrous materials generally contain, before they are spun or drawn, a portion of some deliquescent salt, which becomes either embedded in or deposited on the leather with which the peripheries of ordinary drawing rollers are covered; and that in damp weather the salt attracts moisture, which causes the fibres to "lap." Now the present invention consists in substituting for leather, tubes of vulcanized India rubber, whereby a repellent surface, or one not liable to absorb moisture, is obtained, so that any fibrous materials, undergoing the process of spinning and drawing, will not be liable to "lap," or to be drawn round the roller, and will be delivered in an unbroken and uniform state. To render surfaces of the vulcanized India rubber tubes better adapted to the purposes of this invention, they are boiled for from four to six hours in an alkaline solution (using, by preference, caustic soda or caustic potass), to which is added flour of sulphur. The alkalies render the caoutchouc more solid, and the sulphur gives to its surface a degree of roughness, which renders it better fitted for drawing than before. In order to retain the vulcanized tubes in position, and prevent their riding off the cylinders, the ends of the latter are provided with collars.

Claim.—The construction of drawing rollers, to be employed in the manufacture of silk, cotton, woollen, and other fabrics, by covering the peripheries of cylinders, composed of any suitable material, with tubes of vulcanized or metallo-thionized caoutchouc prepared and fitted as described.

William Edwards Staite, of Throgmorton-street, London, gentleman. *For improvements in pipes for smoking, and in apparatus connected therewith.* Patent dated March 2, 1850.

Claims.—1. A combination of parts, both as regards pipes and stems, having a diaphragm, whereby the oil and condensed vapour are intercepted and collected in a receiver, and are thus prevented from entering the mouth of the smoker.

2. A valve stem and slide-piece, whereby waste of tobacco and smoke by the "back puff" is prevented.

3. An improved tobacco-stopper.

[The details of this invention, with engravings, in our next.]

WEEKLY LIST OF NEW ENGLISH PATENTS.

Sir John Scott Lillie, Companion of the most Honourable Order of the Bath, of Paris, France, for certain improvements in the application of motive power. September 5; six months.

John Saul, of Manchester, cotton spinner, for certain improvements in machinery or apparatus for spinning and twisting cotton and other fibrous substances. September 5; six months.

George Smith, of Manchester, engineer, for certain improvements in steam engines, and also improvements in feeding or supplying the boilers of the same, part or parts of which improvements are also applicable to other similar purposes.

William Watt, of Glasgow, North Britain, manufacturing chemist, for certain improvements applicable to inland navigation, which improvements or parts thereof, are also applicable generally to raising, lowering, or transporting heavy bodies. September 5; six months.

Andrew Barclay, of Kilmarnock, Ayr, North Britain, engineer, for improvements in the smelting of iron and other ores, and in the manufacture or working of iron and other metals, and in certain rotary engines and fans, machinery, or apparatus as connected therewith. September 5; six months.

William Erskine Cochrane, of Cambridge-terrace, Regent's-park, and Henry Francis, of Princes-street, Rotherhithe, for improvements in propelling, steering, and ballasting vessels in the pistons of steam engines in fire-bars of furnaces, and in sleepers of railways. September 5; six months.

Frederick Woodbridge, of Old Gravel-lane, Middlesex, engineer, for improvements in machinery for manufacturing rivets, bolts, and screw blanks. September 5; six months.

John Beattie, of Liverpool, engineer, for certain improvements in steering vessels. September 5; six months.

James Mather the younger, of Crow Oaks, Pilkington, Lancaster, bleacher, and Thomas Edmeston, of the same place, calenderman, for certain improvements in machinery or apparatus for scouring, finishing, and stretching woollen, cotton, and other woven fabrics. September 5; six months.

Christopher Cross, of Farnworth, near Boston, Lancaster, cotton spinner and manufacturer, for certain improvements in the manufacture of textile fabrics; also in the manufacture of wearing apparel and other articles from textile materials, and in the machinery or apparatus for effecting the same. September 5; six months.

James Rennie, of Goward Bank, Falkirk, Stirling, Scotland, gentleman, for a certain improvement or improvements in the construction of gas retorts and furnaces, and in apparatus or machinery applicable to the same. September 5; six months.

LIST OF IRISH PATENTS FROM 21ST JULY TO THE 19TH AUGUST, 1850.

Eugine Ablon, of Panton-street, Haymarket, Middlesex, for improvements in increasing the draft in chimneys of locomotive and other engines. July 31.

Joseph Barans, of St. Paul's, Deptford, Kent, Esq., for improvements in axles, and axle boxes of locomotive engines, and other railway carriages. August 1.

Thomas Dickson Rotch, of Drumlamford house, Ayr, Esq., for an improved mode of manufacturing soap. August 1.

Louis Napoleon Le Gras, of Paris, civil engineer, for improvements in the separation and disinfection of fecal matters in the manufacture of manure, and in the apparatus employed therein. August 3.

Thomas Keely, of the town and county of the town of Nottingham, manufacturer, and William Wilkinson, of the same place, framework knitter, for certain improvements in looped or elastic fabrics, and in articles made therefrom; also certain machinery for producing the said improvements, which is applicable, in whole or in part, to the manufacture of looped fabrics generally. August 3.

John Gwynne, of Lansdowne Lodge, Notting-hill, merchant, for improvements in obtaining motive power, and in applying the same to giving motion to machinery. August 6.

George Augustus Huddart, of Brynkir, Carnarvon, Esq., for certain improvements in the manufacture of cigars, and certain apparatus for smoking certain cigars. August 16.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Aug. 31	2421	William Elliot Carrett,	Leeds	Steam pump.
"	2422	William Bird	Oxford-street	Boot.
"	2423	Michael Macmanus	Blackburn, Lancashire	Parexograph, or self-acting copying guide to assist in copying writing.
"	2424	David Hodge and Thos Roberts	Hatton Garden	Candle lamp.
Sept. 3	2425	John Tanner	Bristol.	Trousers.
"	2426	William Newman, and William Newman jun.	Wolverhampton and Birmingham	Imperial door spring.
"	2427	Alfred Moring	Artillery-place, West Bunhill-row.	Nepaulese braces.
4	2428	L. D. Smith	Little Knight Rider-street	Colouring embossing apparatus.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London— Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1414.] SATURDAY, SEPTEMBER 14, 1850. [Price 3*d*., Stamped, 4*d*.
Edited by J. C. Robertson, 166, Fleet-street.

SHIPTON'S RECIPROCATING STEAM-ENGINE.

Fig. 1.

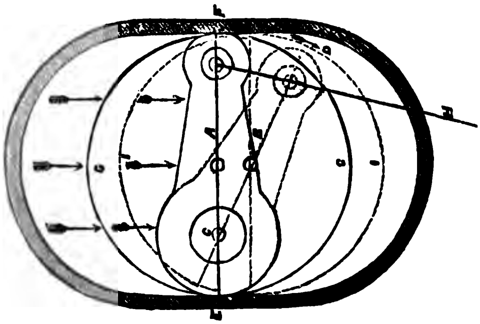


Fig. 2.

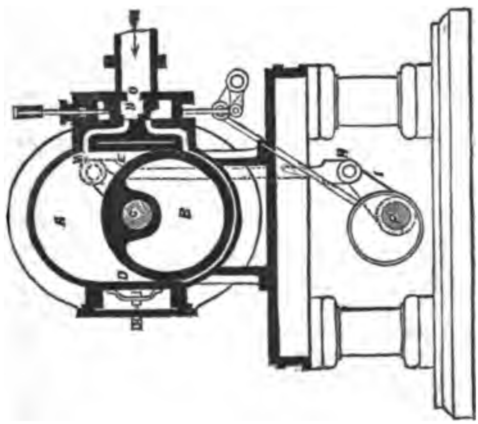
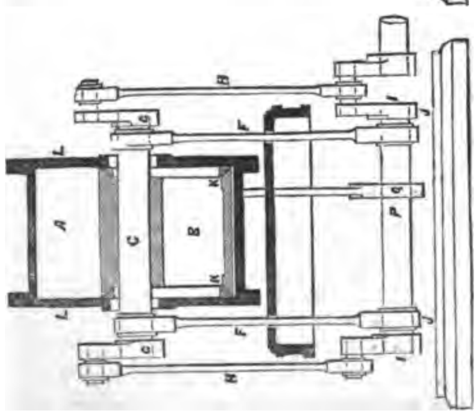


Fig. 3.



DESCRIPTION OF A NEW RECIPROCATING STEAM-ENGINE. BY MR. SHIPTON, OF MANCHESTER.

[From Transactions of the Institution of Mechanical Engineers. July, 1850.]

The subject of the present paper is a steam-engine of the reciprocating class, only differing from the ordinary engine in the means adopted for obtaining the revolving motion direct out of the rectilinear: the principle through which power is obtained being the same as the ordinary reciprocating engine, viz.—a piston acted upon by steam being propelled in a rectilinear direction in a cylinder or steam-chamber, which in the present case is square or rectangular, instead of circular.

From the many and often unsuccessful attempts to obtain a continuous motion direct out of the piston, and also the variety of rotary engines that have hitherto appeared before the public, it is the author's wish to point out clearly the nature of this invention in the first place, so that no impression may be formed that it is of the rotary class, but simply a short stroke reciprocating engine, the germ being "an eccentric revolving in its own diameter," which is nothing more or less than the piston and crank combined in one body, and this body containing in itself two distinct motions, viz.—rectilinear and revolving; both of which motions are common to the ordinary engine.

Feeling convinced of the economy and good effect resulting from the ordinary reciprocating engine, it has been the inventor's aim to approximate as closely as possible to the principle, but they are of opinion that many important modifications and improvements, may still be made; it has been their endeavour,—

Firstly. That the power of the steam should be conveyed to the main shaft or axle in the most direct and simple method (taking the oscillating engine as a fair example).

Secondly. To construct such an engine that it may with safety be worked up to an extraordinary number of revolutions, without causing the piston to travel through an excessive amount of space.

Thirdly. To arrange such a plan that the steam may be used expansively, without inconvenience and complexity of parts.

Fourthly. To take care that no amount of the piston's surface should be in rubbing contact, except that which is the real effective portion under the action of the steam (which the author considers is only the case with the common cylinder and piston-engine and the one under notice, hence the excess of friction in most of the former modifications).

Fifthly. To form certain parts of the engine to act as fulcrums to the moving parts, so that the whole lifting power may be self-contained, and thereby secure a steady, fixed, and uniform motion.

Sixthly. To provide against any excess of wear of one part more than another, and all those parts, both internal and external, to be easily repaired, or even replaced without renewing heavy parts of machinery, such as cylinders, &c.; and also that no crooked forms and contrivances need be resorted to, to bring back the first motion into a safe and useful form, such as guides and crossheads, or parallel motions, or even the fact of a piston-rod giving out its power at a considerable angle, when the crank is most effective, thus altogether depending upon the length of the connecting-rod, the evil of using short rods being generally admitted.

Having thus briefly described the views of the inventors, the author will proceed to show the analogy that this engine bears to the piston and crank of the ordinary engine, and on reference to fig. 1, A is the crank of an ordinary engine, on the shaft C, in full power or the most effective position, and the whole power is conveyed through the line H, at an angle varying according to the length of the connecting-rod, and the position of the crank.

It is the author's opinion, that if steam could be brought to bear upon the crank direct, it would be a more simple and ready means than at present in use, and for the sake of illustration, suppose A (fig. 1,) is a crank filling up completely between the sides of the steam chamber EF, and when steam is admitted on the top of the crank A, as indicated by the arrows, it would move into the position shown by B; but in that position it must be observed that the same crank would be too short to fill up the steam chamber, and, consequently, the steam would rush by the end D: it therefore becomes necessary to change the form of the crank, and to make it such, that at every position, the space between EF may be filled by it, which form at once resolves itself into the circle GG, with the shaft or axle C passing through it, out of the centre, thus far resembling the common eccentric; and it will be seen that when steam is brought to bear upon its entire surface, as shown by the arrows, it is thereby propelled bodily, into the dotted position II, and from the fact of being an eccentric, a revolving motion is obtained during its propulsion, and here are the piston and its appendages, and also the crank of the ordinary engine contained in one body.

It is immaterial on what form of a piston the steam acts in case of bodily propulsion; and for the purpose of illustrating this subject further, suppose the shaft or axle, and crank to be dispensed with, and the steam to act upon the circle GG, as shown by the arrows; this circle, or body, would be propelled in a rectilinear direction only, which would have to be converted into revolving motion in the ordinary manner, and through a number of parts. It therefore becomes a question, whether the two motions common to the ordinary engine, viz.—rectilinear and revolving, cannot be advantageously blended together in one body.

Figs. 2 and 3 show transverse and longitudinal sections of the engine. A is a steam chamber, serving the purposes of a steam cylinder (therefore it will be so denominated in the following explanation), and is of cast iron; having the plate E dovetailed in and fitted fast, and the plate D fitted loose in the parallel recess, though sufficiently accurate to prevent any escape of steam; the plate D is for the purpose of following up the piston as it wears, and is adjustable to its work by means of springs behind it, or by the admission of steam by a small steam pipe, the former mode being preferable. This plate also answers another purpose—in cases of priming the water in the cylinder forces back the plate, and rushes from one side to the other of the piston until it escapes, and thus preventing accidents arising from this cause.

The circular ends of the cylinder are left black and unbored, as it will be seen the periphery of the piston does not come in contact with any other part of the cylinder but the two plates D and E, and consequently the tedious and costly operation of boring the cylinder is entirely dispensed with. The plates D and E, on which the wear takes place in the cylinder are easily replaced at any period, and can be removed without taking any of the rods off by simply pushing the side plates L L on one side. These plates L L are planed surfaces, against which the piston ends rub, and the joint to the cylinder is metallic. It will be noticed that these plates have holes or slots in them of a peculiar form, which are for the purpose of getting them over the cranks G G, though a slot of sufficient size to allow the shaft C to traverse clear would do, if this were not the case.

The piston B is an eccentric keyed on the shaft C, and carried on the rods F F, vibrating from the crank-shaft pedestals; this piston is turned true on the periphery, and in each end are turned conical seatings, into which are fitted rings of metal K K, cut open on one side, and leaving a lap joint to prevent any escape of steam. These rings are each under the control of a bolt, and can be adjusted through the slots in the side plates L L without removing a single nut, and thus are easy of access; the peculiar wear and the means adopted for obtaining a steam-tight joint are worthy of notice, and will be described hereafter.

The cranks G G are keyed on the shaft C at right angles to each other, and equidistant from a line drawn through the centre of shaft and centre of the piston, and through these cranks the power is merely conveyed through the rods or drag links H H to the lower cranks I I on the main shaft, but these cranks can be keyed on at any other angle, as they only transmit the power, and consequently can be of any suitable length, independent of the stroke of the engine.

It will be seen that the vibrating rods F F are carried on the pedestals J J, which have a gudgeon turned in the centre on which the rod vibrates, so that all the wear that takes place on this bearing is caused by the vibration of the rod, which is very slight.

Steam is admitted by means of a valve N through the steam ports or ways M M to the top and bottom of the piston alternately, the same as in the ordinary engine; though the construction of the valve shown here is different, an ordinary slide valve would answer this purpose as well as in any engine, as its office is precisely the same. This valve is on the equilibrium principle, and exhausts through the back, and works between two parallel planed surfaces, the wear that takes place being accommodated by a ring of metal O similar to that employed for packing the end of the piston; the peculiar advantages of this valve are, being light and easy, and suitable for high speeds, ready exit for the exhaust steam, and extreme simplicity. This valve is worked by an eccentric Q keyed on the crank shaft P, and by levers, weigh shaft, &c.

The cylinder, &c., is bolted down to a framing or entablature, which can be altered as desired, and the entire engine is placed on a foundation plate, and fixed in the ordinary manner.

The mechanical difficulties to be encountered in this engine were the method of keeping the piston steam tight, and also the peculiar wear at the periphery and ends of the piston. It will be seen, that should there be an escape of steam it will readily be perceived issuing out of the slot holes in the side plates L L. The piston ends are made tight by rings of metal K K fitted into a conical seating as before described. These rings are cast open and drawn together by a bolt after the joint is filed square; and it entirely depends upon this joint whether the ring be steam-tight, as if it be not true the ring will be drawn out of its

natural shape, and when released after it has been turned true, it will spring back to its own shape, therefore it is preferable to file the joint in such a manner that the ends of the ring may have a tendency to spring outward, and thus the difficulty is removed. It will be seen that the motion on the piston ends is an elliptical one, and from the fact of the rings being disconnected with the piston they are at liberty to move in their seating, and the peculiar motion, viz.—ellipses of all sizes, varying according to the proximity to the centre on which the piston turns, causes the rings slowly and gradually to traverse round in their seatings, thus accomplishing a most desirable object, that no two surfaces go over the same lines twice together.

The periphery of the piston has likewise a beautiful wear, as it will be seen at the same time it is revolving it is passing up and down the plates D E the length of the stroke, and from this motion excessive wear is not anticipated.

MR. TATE ON THE STRENGTH OF MATERIALS.*

We are glad to meet Mr. Tate on this new ground—for here we are able to award him that praise which on some recent occasions we were compelled to withhold. We withheld it then with sincere pain; we award it now with corresponding pleasure.

Mr. Tate has now selected a subject of which he is a perfect master: we are inclined to think the most complete master of all living writers. It is a subject, too, which he has carefully studied in all its bearings, and with the literature of which he is evidently well-acquainted. We trust he will continue to devote his attention to such subjects; and leave book-making for the Committee of Council, to those who are more conversant with the development of the human faculties and with the philosophy of the human mind, than he had the misfortune to prove himself. But we proceed to the book itself—not, indeed, to give either a laboured analysis or a discussion of the topics embraced in it, but a sufficiently general account of it to enable our readers to see its objects and to estimate its value, with a few preliminary remarks on the progress of the philosophy of beams.

The form in which Mr. Tate considers the strength of materials is in that of beams alone. This, indeed, is the great, though not the only engineering problem, in which the question of strength might, and does, arise. For instance, without going further, the strength of pillars might have been included —or these pillars expanded into walls. Again; in roofs the same question arises; and, having some analogy to these, buttresses also. However it was, we think, judicious on the part of Mr. Tate to confine himself mainly to the horizontal beam; for from this, which, except the vertical pillar, is the most manageable and best understood case, we shall ultimately obtain valuable data and suggestions towards the elucidation of the strength of oblique beams subjected to forces, which are neither in their own direction nor perpendicular to them—such as roofs and shoars, for instance.

Whilst constructions were rude and timber plentiful, the early builders raised thick walls and laid dressed oak trees across them for beams. By degrees walls were contracted in thickness, and the beams diminished in both directions of breadth and thickness. Originally, buildings were designed to outlast the neighbouring castle; but afterwards the builder was satisfied with the prospect of a few centuries' duration. *Now* we build upon leases of from sixty to ninety years — usually seventy or thereabouts. A much lighter style is thus introduced, and a more perishable wood employed; the walls will barely resist an "equinoctial gale," and the roofs are endangered by a heavy lodgment of snow. In this age of "every man his own landlord," houses are run up (like Moses Primrose's razors) "for sale;" and generally they

* "On the Strength of Materials; containing Various Original and Useful Formulæ, Specially Applied to Tubular Bridges, Wrought Iron and Cast-iron Beams, etc." By Thomas Tate, Author of the "Principles of the Differential and Integral Calculus, Factorial Analysis, etc." 96 pp. 8vo. Longmans, 1850.

are built in company, like a set of urchins venturing for the first time on the ice, to hold each other up.

For our domestic architecture, therefore, this problem of beams has ceased to possess either interest or value. On the other hand, however, our centralization of the labours of the artizan has given rise to monster-mills, warehouses to stow away the produce of a county, and single rooms to display the manufactured elegancies of half the globe in some department or other. Above all, our transit system has given rise to engineering structures of every possible description, and these upon a scale so gigantic as would to our forefathers, have appeared more incredible than the gorgeous magnificence conjured up in an oriental fairy tale. Wood, the largest ever grown, was often useless here; and, moreover, too costly, even could it have been procured at any price, to render its use feasible. Iron was impressed into the service: but as iron was made in our younger days, that, too, was useless, from its tendency to fracture, beyond a certain magnitude; and even the safety of a moderate beam, from imperfections of castings, was at all times dubious. Its own weight, also, tended to destroy it; and a house with iron beams or pillars, even of moderate dimensions was anything but a safe abode.

A hundred modes of improving the quality, both as to strength and rigidity, have been devised, patented, and most of them superseded in turn by better modes of making and casting. The hydraulic press, and other methods of testing each particular piece, have enabled a sound judgment to be formed by engineers of the adequacy of every component part of a system of iron-work, to the strain, pressure, impact, or whatever other kind of force it has to resist. Cast iron is, therefore, now used with confidence and safety in works of considerable magnitude; and we believe that where proper preliminary tests have been applied, no failure of any consequence has been known to take place. Such catastrophes as that recorded at Preston in our Magazine of the 10th ulto., have all been traced either to criminal negligence or to disreputable want of skill on the part of the engineer.

The idea of *hollow pillars* was natural enough; and this would naturally suggest that of hollow beams—which would at least have the recommendation of lightness, even if the expense of that mode of casting should absorb the savings from less material being used.

But the great question that would here arise was the relative strength of two beams, one solid and the other hollow. Men, except the most reckless, would feel so much timidity respecting this point, that few would venture upon the experiment in actual building; and the experiments were too costly to be made upon a sufficient scale, and with proper care, by even a manufacturer himself. No engineer would do it on his own private account. The use of hollow beams, therefore, has been but rarely adopted, and in no case upon any magnified scale in cast iron. In fact, even for solid beams, the inquiry into the strength and circumstances of fracture, has been only very recently investigated by experiment, or discussed mathematically, to any satisfactory extent and with any satisfactory results. This is due almost exclusively to Mr. Hodgkinson, and his researches have deserved (and—what is wonderful—obtained) the warmest commendations of the engineering profession—a profession whose jealousies are equalled only by those of the medical.

It was very natural to turn the attention to the use of wrought iron. Many obstacles, however, intervened, of which the inevitable expense was not the least. The cases are very rare that would justify an engineer in encountering this one obstacle; but he did now and then on a comparatively small scale. It is to one single circumstance, however, that we owe the attention of the engineering world being intensely directed to the question—the *necessity* for the now celebrated Britannia Bridge. Here, too, it came in its *most trying form;* and it was clear that, if the scheme were successful in this case, it might be fully and with facility relied on, in almost every other conceivable case.

The first and most obvious use of wrought iron was, however, in the solid form, thereby lessening both bulk and weight; and where this can be done, it is even now the most safe, and is always the most economical mode of its application. True, it is not easy —perhaps not possible—to exceed a certain magnitude with complete security; but then, at the same time, it can be formed in pieces, like wood beams, and these offer greater facilities for secure joinings than can be applied to segments of a wooden beam. The drawback is, that the securings can be subjected to no criterion of strength prior to erection—in fact, to none at all but that of whether the erection does actually maintain its position.

When the Britannia Bridge was first conceived to be of possible erection, it is more than possible (we have, however, no authority for saying that such was the case) that the first idea was that of a mere hollow iron beam, on the top of which, instead of through it, the trains should pass. The decision to run *through*, throwing the forces immediately upon the plates which formed the lower face of the structure, altered the ordinary conditions. The sides and top are merely employed to counteract the pressure on the bottom plate; and, indeed, the sides operate little further (and that further unfavourably) than as rigid connectors of the top and bottom faces of the tube. The admirable contrivance of stiffening the upper face (why not *also* the lower outwardly?) by cells, is perhaps one of the most happy conceivable; and we have no doubt that this and the corner angle irons are the great sources of safety to the whole structure. The selection of iron, the mode of working, the magnitude of the plates, the riveting, and a thousand other details, are mere matters for professional judgment and experience, to which many an engineer may lay fair claim: but the idea of a tunnel bridge, and the mode of stiffening, form the points upon which the originator and his equally able coadjutor may trust to being especially remembered in the annals of the most wonderful engineering age and country in the world.

To return, however, to Mr. Tate, from whose book we have been led to digress much more than we intended, we propose to give but a slight account of its contents; for we are sure that every one of our readers who feels the least curiosity or interest in the subject, will at once refer to the book itself, and feel grateful for our having directed his attention to it.

Of course, in the time which has elapsed since Galileo first attempted to philosophise on the subject of the strength of beams, many theories formed with the view of submitting the problem to mathematical analysis have been propounded. The subject has long been a "standing dish" in our elementary treatises on mechanics; and the phenomena of loaded beams have been over and over made the subject of experiment on a small scale, and of induction in an incommensurately large one. All, however, that can be fairly deemed to be safely established, will be found in Mr. Tate's volume, placed in as succinct and intelligible a form as the subject admits; that is, in a very simple form to every mind that has acquired the rudiments of mathematical science, and to none else can even the results be rendered intelligible without immense circumlocution.

The "preliminary observations and formulæ" are expressed with considerable neatness, and in a very intelligible form. pp. 1—4.

The "neutral axis" and its geometrical properties follow. Of course, these were well known; but they are presented here in, probably, their best possible form.

Next follows a short chapter on the "conditions of rupture;" it however not only includes all that had been previously given by others, but it is applied on the hypotheses of Galileo, Leibnitz, and Mariotte to the experiments of Barlow, and to the practical inference of Fairbairn. It is remaakable, that in the ultimate case (fracture) the three hypotheses agree. The Conway tube is, however, more completely investigated in a later stage of the work. The moment of inertia, the cen-

tres of compression and extension, and the change of the axis of moments, with their application to the deflexion of beams, next follow. These may be considered to comprise the *elements* of the subject.

"The general formulæ relative to similar beams" are very important to the engineer. Amongst them is comprised the relation between a structure and its model, upon the value of which no remark is necessary. The Conway tube and Cubitt's cast-iron beams with double flanges are computed in this chapter. The chapter concludes with a section on the deflection of similar beams.

In the next chapter the same inquiries are instituted, when the beams are "only similar in certain respects."

This is followed by an extended chapter on the strengths, &c., of "various forms of beams;" the hollow beam being discussed much more completely than has been attempted by any preceding writer. Into this he introduces all the conditions of stiffening and strengthening by means of the circular system and the angle irons of the tube. Taking all these into consideration, he computes the breaking weight of the Conway tube at 2,013 tons.* We give his concluding remark.

"In the preceding calculations it has been assumed that a tubular beam follows the same laws of transverse strain as an ordinary solid beam.

"The model tubular beam constructed by Mr. Fairbairn gave the true form and elements of the Conway and Menai Bridges; and the result of his experiments upon this beam will doubtless be regarded by a future age, if not by the present, as one of the most important experimental facts, relative to the strength of material, which has hitherto been discovered.

"Now in this model beam, the principle of crumpling seems to be eliminated by the thickness given to the plates, by the combination of the cells, and by the *strong* angle irons used in connecting the plates. This is rendered apparent from the fact, that the top area is nearly equal to the bottom one, when the equality of resistance is attained. Hence the model tubular beam may be regarded as a common beam obeying the ordinary laws of compression and extension when subjected to transverse strain. The assumption, therefore, that the Conway tube will have the same resistance to compression in its top structure as the thin rectangular cells experimented on by Mr. Hodgkinson, is erroneous in principle; and this is rendered more apparent from the calculations on the model tube given in Article 65, where the resistance per square inch to compression is found to be almost eighteen tons in the place of eight tons, which Mr. Hodgkinson assigns to it. It would further appear, that when a beam of this kind is broken by transverse strain, the material in the top cells undergoes a more complex strain than that exhibited by a simple crushing force, where the material is not allowed to bend under the pressures applied to it. Without incurring a great amount of error, the model tube may be treated on the assumption that the material is perfectly elastic."*

Mr. Tate next proceeds to consider beams of cast iron of different forms, and gives much interesting information on this most important topic. No architect, engineer, or builder will do justice to himself who does not carefully study this portion of Mr. Tate's work.

Cylindrical beams, their comparison with square beams, and a similar comparison as to cylindrical and square cells, next follows. The author finds that "with the same material the square beam has 1½ times the strength of the cylindrical one." p. 74. The "observations relative to the best form of the cells in a tubular beam," bespeak their importance by their title, and we deem them as valuable as the subject is important; and the explanation "why the cellular structure exhibits such strength" is a peculiarly

* On this subject one word. It has been held by some engineers, and is apparently established by observation (in part at least) that wrought iron subjected to impact, tends by the internal vibrations so produced, to restore itself to the crystalline structure. If the fact be as stated, what are the prospects of our tubular bridges? Would it not be prudent to ascertain their power of resistance, viewed as made of cast iron? We merely throw out the suggestion, and leave others to follow it up.

* No term expressive of ordinary physical phenomena is more vaguely understood than the term *elastic*. We shall probably give a short dissertation on the subject hereafter. Mr. Tate defines his meaning of the term at the very opening of his work, thus; "When the resistance of compression is equal to that of distension, the material is said in this respect to be perfectly elastic, which is usually the case in bars of wrought iron. But in most kinds of material these forces are different: thus, in cast iron the compressive resistance is about six and a half times that of the tensile resistance."—p. 1.

neat and elegant piece of philosophical discussion.

Lastly, the investigation of the strength of elliptical and parabolic beams—in the former case, both solid and hollow—concludes the volume. It is, however, of necessity almost entirely theoretical; that is, untested by direct and conclusive experiments. To obtain such experiments transcends the limit of private means; they could only be made by a Government commission—of which, should any ever be appointed, Mr. Tate ought, certainly, to be a member.

EXPERIMENTS ON THE POWER WHICH MAINTAINS BODIES IN THE SPHEROIDAL STATE, BEYOND THEIR SPHERE OF PHYSICAL AND CHEMICAL ACTIVITY. BY MONS. BOUTIGNY, OF EVREUX.

[Translated from the *Moniteur Industriel*, for the *Mechanics' Magazine*.]

The diversity of opinion existing as to the cause of the tendency of bodies to assume the spheroidal state, induced me to make the following experiments.

I rolled in a spiral form a platinum wire of 0 m. 001 in diameter, so as to make a sort of sieve with continuous circular meshes; I then poured into this vessel water, alcohol, and ether successively; and, as may be supposed, these three liquids ran through the meshes of the vessel as through a sieve.

This fact ascertained, I made the vessel red hot, and repeated the experiment with the three above-mentioned liquids, when I beheld a repetition of the miracle of the vestal "Tuccia;" that is to say, these three liquids no longer passed through the meshes of the sieve, but could actually be removed from place to place, as if in a close vessel.

As to the alcohol and the ether, I observed that the vapour they generated (its density being considerably higher than that of the air) formed an equilibrium (or a counterpoise) up to a certain point, with the ascending current of hot air produced by the high temperature of the vessel; and this vapour escaping through the meshes of the vessel, ignited above and below; thus the spheroid of liquid became interposed between the bases of two cones of flame. Thence it is clear, that the vapour escaping freely and uniformly from the whole surface of the spheriod, would not be adequate to produce a reaction sufficient to neutralize the influence of gravity, and to maintain the spheroid beyond the sphere of physical and chemical activity.

In repeating the preceding experiment with iodine, it is still more conclusive. The lower cone of flame is replaced by a beautiful column of violet vapour, which falls through the meshes of the sieve, immediately underneath the spheroid of iodine.

The experiments which I have just summarily described appear to me to establish fully the existence of this mysterious repellent power which neutralizes the action of gravity. Certainly these experiments do not prove that the action of attraction is destroyed, but they show that we should also take the repulsive power into consideration.

What, then, are the laws of this power? To what distance does its influence extend? What is the action of the earth, or of the incandescent body, as to its nature, its bulk, and its temperature? What is the effect of the density of the body which is rendered spheroidal?—Many other questions arise on this subject, which presents, if I mistake not, one of the most extensive fields for analytical investigation.

The truth is, that the spheroidal state is the primordial condition of matter; that all the phenomena which during fifteen years I have had the honour of submitting to the Academy, belong to the physical condition of the primitive eras of the globe;—that all the experiments of the laboratory, were accomplished on a vast scale, upon the surface of the earth, at the period of its incandescence.

Immense researches might be made on this subject, and innumerable results collected from its investigation.

THE GUTTA PERCHA TRADE.

Previous to 1844, the very name of gutta percha was unknown to European commerce. In that year 2 cwt. of it were shipped experimentally from Singapore. The exportation of gutta percha from that port rose in 1845 to 169 piculs (the picul is 133½ lbs.); in 1846, to 5,364; in 1847, to 9,296; in the first seven months of 1848, to 6,768 piculs. In the first four and a half

years of the trade, 21,598 piculs of gutta percha, valued at 274,190 dollars, were shipped at Singapore; the whole of which was sent to England, with the exception of 15 piculs to Mauritius, 470 to the continent of Europe, and 922 to the United States.

But this rapid growth of the new trade conveys only a faint idea of the commotion it created among the native inhabitants of the Indian Archipelago. The jungles of the Johore were the scene of the earliest gatherings, and they were soon ransacked in every direction by parties of Malays and Chinese, while the indigenous population gave themselves up to the search with an unanimity and zeal only to be equalled by that which made railway jobbers of every man, woman, and child in England about the same time. The Tamungong, with the usual policy of oriental governors, declared the precious gum a government monopoly. He appropriated the greater part of the profits, and still left the Malays enough to stimulate them to pursue the quest, and to gain from 100 to 400 per cent. for themselves on what they procured from the aborigines. The Tamungong, not satisfied with buying at his own price all that was collected by private enterprise, sent out numerous parties of from 10 to 100 persons, and employed whole tribes of hereditary serfs in the quest of gutta percha.

This organised body of gum-hunters spread itself like a cloud of locusts over the whole of Johore, peninsular and insular. They crossed the frontier into Ligna, but there the Sultan was not long in discovering the new value that had been conferred upon his jungles. He confiscated the greater part of what had been collected by the interlopers, and in emulation of the Tamungong declared gutta percha a royalty.

The knowledge of the article, stirring the avidity of gatherers, gradually spread from Singapore, northward as far as Pinang, southward along the east coast of Sumatra to Java, eastward to Borneo, where it was found at Bruné, Sarawak, and Pontianak on the west coast, at Keti and Passir on the east. The imports of gutta percha into Singapore from the 1st of January to the 12th of July, 1848, according to their geographical distribution, were:—From the Malay Peninsula, 593 piculs; from the Johore Archipelago, 1,269; from Sumatra, 1,066; from Batavia, 19; from Borneo, 55. The price at Singapore was originally 8 dollars per picul: it rose to 24, and fell about the middle of 1848 to 13.

The commotion among the human race in the Archipelago was great, but the vegetable kingdom suffered most by it. In the course of three and a half years 270,000 trees were felled in order to get at the gum.—*Daily News.*

YERBURY'S PATENT DIAPHRAGM SMOKING PIPES.

William Edwards Staite, Patentee.

As promised in our last, we now proceed to give the specification of Mr. W. E. Staite's improvements in pipes for smoking.

Specification.

This invention consists, *first*, in so constructing the bowls and tubes or stems of pipes as to prevent (as far as practicable) the oil resulting from the combustion of tobacco from passing up the tube, and thence into the mouth and stomach of the smoker, thereby avoiding or greatly mitigating the evils arising to some constitutions from smoking; *second*, in certain additions to pipe stems or tubes; and *third*, in an improved tobacco-stopper.

Fig. 1 is a sectional elevation of one of my improved pipes, which I propose calling "the Patent Diaphragm Pipe." A is the bowl, terminating at bottom in a tube B, which extends down nearly to the bottom of a cup or receiver; C is a perforated diaphragm fitted to or cast on the outside of the tube; D is a moveable cup fitting on to the bottom of the pipe; E is the socket, into which the stem or tube to convey the smoke to the mouth is inserted. This socket is in all cases above the diaphragm, so that before entering the stem the smoke must pass down the small central tube D, impinge against, and pass through the perforated diaphragm, and then enter the stem, as shown by the arrows in the figure. The oil and vapour being intercepted, fall into the cup D, which should be taken off and the contents emptied before throwing the ash from the bowl, in order to prevent the oil running back into the bowl, or finding its way into the tube or stem.

Fig. 2 is a sectional elevation of another of my improved pipes, which I also propose calling "the Patent Diaphragm Pipe." A is the bowl; B a hole communicating with a chamber beneath; C is a solid division or partition pointed at bottom in the centre, to facilitate the dropping of the oil and condensed vapour into the cup. It may be placed perpendicularly down the centre, or inclined at any angle; attached to it at bottom is a

pierced diaphragm, as shown in the figures

The smoke in this case passes from the bowl through the hole B, down the side of the partition, then impinges on the diaphragm, passes through the same as before, and so into the stem, as shown by the arrows in the figures.

Fig. 1.

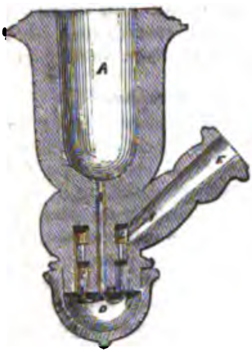


Fig. 2ª.

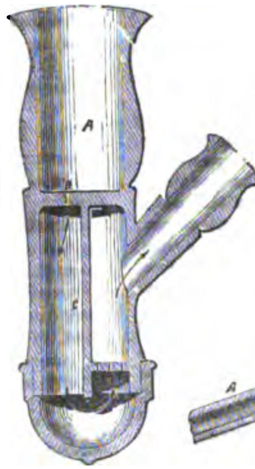


Fig. 4.

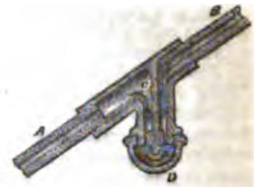


Fig. 5.

Fig. 2.

Fig. 3.

Fig. 6.

Fig. 2ª is a modification of the pipe last described.

Either of the foregoing pipes may be constructed with one or more diaphragms, and these diaphragms may be inserted in pieces, not pierced, step fashion, one above another, as shown in section (fig. 3). Also for the better and more perfect collection of the oil and vapour, a diaphragm, pierced as before described, may be inserted in any suitable part of the socket into which the stem is to be placed.

Fig. 4 represents part of an improved stem or tube, which may be used either with the pipes before described, or with pipes of ordinary construction, where moveable stems are employed. A is the piece which fits into the socket of the pipe. B is the piece on to which the mouth-piece fits. C is a solid division or partition which is fitted into a cylinder, and carries a perforated diaphragm attached thereto. The course the smoke follows is indicated by the arrows. D is a moveable cup for receiving any surplus oil or condensed vapour which may not

have been collected in the cup of the bowl, or in cases where the pipes here described are not used, then it collects the oil and condensed vapour directly as they come from the bowl of ordinary pipes.

Fig. 5 is a sectional view of another addition to stems, which may be used separately or in conjunction with the foregoing. A A is the stem. B is a hollow projecting piece, to the inside of which are fitted three stops or bridges *a b c*. *d* is a valve opening upwards towards the mouth and resting on the stops *b* and *c* when closed. *d'* is a pin which passes through the side of the projecting piece, and terminates inwardly in a slide *e*. This pin serves to press the slide over the aperture between the stops *a* and *b*, and is prevented from rising by the spring *f*; a helical spring *g* keeps the pin out, and prevents the slide closing the aperture except when required. This contrivance allows air to be blown through the stem to clear it, when necessary, and prevents waste of tobacco by the back puff, when smoke is being expelled from the mouth.

Fig. 6 represents an improved tobacco-stopper to be used with either of the pipes before described, or with pipes of the ordinary kind, such as the meerschaum and German pipes. It may be made to fit on easily, but with sufficient adhesion to hold it in its place, or may be permanently fitted with a hinge-joint, so as to turn over and leave the bowl free for emptying the ashes and refilling the pipe. A is a pipe bowl. *b* a hinged bridge. *c* a stopper of any suitable material, having a rod with a helical or other suitable spring to keep it away from the pipe when out of use, as shown in the figures. By pressing the finger on the rod, the stopper is pushed down into the bowl, and when the finger is removed the force of the spring causes the stopper to retire to its original position.

For Claims, see *ante* p. 199.

ON TUBULAR BRIDGES, AND THE CLAIMS OF MR. STEPHENSON TO THEIR INVENTION.*

Sir,—I beg to preface some observations on tubular bridges by the following extracts from Franklin's works, vol. i., p. 308 :—

"The treatment your friend has met with is so common, that no man who knows what the world is, and ever has been, should expect to escape it. There are everywhere a number of people who, being totally destitute of any inventive faculty themselves, do not readily conceive that others may possess it: they think of inventions as of miracles; —there might be such formerly, but they are ceased. With these, everyone who offers a new invention is deemed a pretender: he had it from some other country, or from some book;—a man of their own acquaintance—one who has no more sense than themselves—could not possibly, in their opinion, have been the inventor of anything. They are confirmed, too, in these sentiments by frequent instances of pretensions to invention, which vanity is daily producing. That vanity, too, though an incitement to invention, is, at the same time, the pest of inventors. Jealousy and envy deny the merit or the novelty of your invention; but vanity, when the novelty and merit are established, claims it for its own. The smaller your invention is, the more mortification you receive in having the credit of it disputed with you by a rival, whom the jealousy and envy of others are ready to support against you, at least so far as to make the point doubtful. It is not in itself of importance enough for a dispute; no one would think your proofs and reasons worth their attention; and yet, if you do not dispute the point, and demonstrate your right, you not only lose the credit in that instance of being ingenious, but you suffer the disgrace of not being ingenuous;—not only of being a plagiary, but of being a plagiary for trifles. Had the invention been greater, it would have disgraced you less; for men have not so contemptible an idea of him that robs for gold on the highway, as of him that can pick pockets for halfpence and farthings. Thus, through envy, jealousy, and the vanity of competitors for fame, the origin of many of the most extraordinary inventions, though produced within but a few centuries past, are involved in doubt and uncertainty. We

* We cannot, consistently with the course uniformly adopted in the conduct of this Journal, which has been to hear both sides on all questions, refuse insertion to this letter from an esteemed correspondent who takes (much to our surprise and regret) a different view from that which we have done, of the rival claims of Mr. Fairbairn and Mr. Stephenson to the invention of tubular bridges. However, lest the present paper should fall into the hands of some reader who may not have read, or may have forgotten what we have said on the opposite side, or who might be led to wrong conclusions by certain erroneous assumptions of the writer, we have subjoined a few cautionary notes, which we hope will be taken as they are meant—in the spirit of truth alone.—ED. M. M.

scarce know to whom we are indebted for the compass, and for spectacles; nor have even paper and printing, that record everything else, been able to preserve with certainty the name and reputation of their inventors. One would not, therefore, of all faculties or qualities of the mind, wish for a friend or a child that he should have that of invention;—for his attempts to benefit mankind in that way, however well imagined, if they do not succeed, expose him, though very unjustly, to general ridicule and contempt; and, if they do succeed, to envy, robbery, and abuse."

The observations on tubular bridges in Nos. 1352 and 1411 of the *Mech. Mag.*, involve a very important principle, viz., at what stage, if any, of an invention, can the aid of scientific and practical men be called in, without the risk of their claiming to be sole or joint inventors, and thereby depriving the first inventor of perhaps the only honour he cares about.

An inventor is the person who first gives to the public a new notion, either by word of mouth, or by drawings, or by signs—in the air, or in any other manner, depending upon the capacity of the person to whom he addresses himself.

An invention has no relation to the trouble, mental or physical, which is necessary to work it out; "to invent or discover is to take off the cover or concealment;" the invention is then completed; and if Mr. Stephenson had been so minded, he could have patented his invention, and a valid specification could have been drawn up without any further communication from him, than the mere fact that he had invented a bridge made of iron so as to form a tube with a roadway through it; nothing more would have been requisite.

So far as invention is concerned it is indifferent what the form or length of the tube is to be—it might be circular, elliptical, triangular, square, or rectangular. The specification need contain no x's and y's, or other mathematical symbols.*

The complaint of the writer in the *North British*, referred to in No. 1411, *Mech. Mag.*, p. 148, amounts to this, that if Mr. Stephenson and Mr. Fairbairn had laid their heads together, they might have prevented "a stranger placing himself in the eyes of the world as the earliest proposer of a tubular bridge." Query the moral honesty of such a proceeding, the fact would have remained the same; and if M. Jules Guyot be the inventor of tubular bridges, why suggest a conspiracy to deprive him of that merit?*

The writer in the *North British* (quoted in the *Mech. Mag.*) finds fault with Mr. Stephenson because he adopted an "Idea as a last resource," "unsupported by theory and untested by experience." It has always been considered that "necessity is the mother of invention," and to invent a thing for which there can be no use would be a mere repetition of the kaleideoscope. Mr. Stephenson, no doubt, kept this tube in his head until it became a great bore, and was doubtless aware that iron vessels had been "stranded with the steam engines in the centre, without injuring the construction of the vessel,"—(In 1842, Mr. Miller published a print of the *Prince of Wales* steamer, showing her position, and pointing out the great strength of iron ships),—and Mr. Stephenson in his evidence before Parliament, May 5, 1845, says, "My own opinion is that a tube of wrought iron would possess sufficient strength and rigidity to support a railway train." That Mr. Stephenson and his tube have been "hung in chains" is no fault of his. General Pasley must

* The writer is altogether in error on this point. Such a specification as he supposes would not have been "a *valid* specification." The inventor would have been required to point out also the way in which the thing was to be performed, and that, too, not only a practicable way, but the very best according to his knowledge or experience. Had he, for example, stated that the "triangular" mode of constructing the tubular bridge might be adopted, he would have stated what was palpably false; and his patent would, on that ground, have been held void. The law affords no such protection as our correspondent imagines to mere abstract and speculative notions.—Ed. M. M.

* The reviewer in the *North British* has certainly given an undue and somewhat inconsistent degree of prominence to the claims of M. Guyot, who never proposed a tubular bridge at all; what he proposed and patented was only a particular form of hollow *girder*, which is quite a different thing. Still, however, it is to misrepresent the reviewer most egregiously, to say that his argument "amounts to this," that "if Mr. Stephenson and Mr. Fairbairn" had done certain things they *might* have secured to themselves the honour of the invention of the tubular bridge; for the entire scope of that argument is to show that all the merit beyond that of mere suggestion, did actually belong to Mr. Fairbairn—"An idea adopted as a last resource, unsupported by theory, and untested by experience, is submitted to Mr. Fairbairn, AND IN HIS HANDS IT BECOMES A GREAT INVENTION."—Ed. M. M.

be answerable for that, as he "decidedly objected to their removal;" and it must be remembered that General Pasley had to examine railway structures, and report upon their safety. Mr. Stephenson while explaining his tubular bridge, "unsupported by theory," to his late father, was accidentally called upon by Mr. Fairbairn, to whom the invention was explained. If Mr. Fairbairn had such intuitive knowledge as to the rectangular form, how was it that his first experiments were made on round ones? Mr. Stephenson when he gave his evidence, May 5, 1845, could have derived no assistance from Mr. Fairbairn's experiments,—as the first experiment was not made until July 6, 1845, two months after Mr. Stephenson had given his evidence.* If Mr. Fairbairn is to be ranked as co-inventor with Mr. Stephenson, why is Mr. Hodgkinson to be left out? Mr. Hodgkinson says, in Report to Commissioners, p. 115, "The introduction of wrought-iron riveted tubes for bridges is a new feature in engineering. It originated with one of our boldest, most skilful, and most successful engineers, who was driven to adopt it as a matter of necessity in one of the most stupendous structures of modern times. To obviate these difficulties Mr. Stephenson, by an effort of originality and master mind, conceived the bold idea of constructing an immense wrought-iron tube formed of plates, riveted together, and sufficiently large to allow railway trains to pass through it."†

Suppose that Mr. Fairbairn had been minded to have patented what he had invented, he must, firstly, have been in the position to swear that he was the "first and true inventor;" this he could not truly do, because the tubular bridge had been previously invented by Mr. Stephenson. Mr. Fairbairn would have been in the same predicament as

"*Dangle* (in the *Critic*).—Yes, I think there is something like it in 'Othello!'

"*Puff.*—'Gad! now you put me in mind on't, I believe there is—but that's of no consequence; all that can be said is, that two people happened to hit on the same thought—and Shakespere made use of it first, that's all."

In December, 1846, Mr. Fairbairn took out a patent, in his own name, for what, he admits in his letter to Mr. Stephenson, Oct. 27, 1846, to have been Mr. Stephenson's "original idea." The "original idea" is what is generally called the "invention," for which letters patent may be obtained: how much of the invention of tubular bridges remains after deducting the "original idea" of Mr. Stephenson?*

Might an orchestral band claim to be the inventors of Handel's oratorios, because they first rehearsed them to fit them for the public ear?

"Go to, therefore, my masters, you that are professed musicians, relate unto this good company here that are your friends, who was the first *inventor* of music."—(Holland's Plutarch, p. 1018.)

As to how the bridge should be made, that appears to have been a joint operation of Mr. Stephenson, Mr. Fairbairn, Mr. Hodgkinson, and Mr. Clark;—so little importance did Mr. Fairbairn attach to the making of the bridge, that he sold his contract to other parties. The ironmasters have, no doubt, some claim, for they "invented" large sheets of iron for this bridge.

Mr. Hodgkinson says, p. 117—"The principal experiments, and the deductions drawn from the whole that had been tried, were in all cases communicated as soon as obtained to Mr. Stephenson, with suggestions bearing on the bridge, and he adopted them or not, as he thought best." Mr. Hodgkinson

* Assuredly not; but what was Mr. Stephenson's idea "when he gave his evidence May 5, 1845?" A self-supported tubular bridge, such as has been ultimately erected? No such thing. His idea at that time, and for a long time after—until Mr. Fairbairn taught him better—was that the bridge should be one suspended by chains from piers—nothing more, in short, than an ordinary suspension-bridge, boarded in at the top and sides!—ED. M. M.

† The reason for Mr. Hodgkinson being "left out," is simply this, that he says himself he should be so, and he ought to know best. His testimony in favour of Mr. Stephenson, though good for nothing as against Mr. Fairbairn—for sundry reasons into which we have not room here to enter, though some of them are obvious enough; but it is good at least to the extent of everlastingly negativing any rival pretensions of his own.—ED. M. M.

* The reader will please refer to what we have already said on this head in a preceding note. The "original idea," such as it existed in Mr. Stephenson's mind, could *not* have been patented, for it was a mere abstract speculation, without any practical embodiment — unless, indeed, the hanging in chains, may be considered as Mr. S.'s practical embodiment of the idea, in which case the patent would have been for a *method of shutting out the light from suspension bridges.* A notable invention truly!

"had been consulted privately on the matter from the commencement, or nearly so;" he is therefore a competent witness. Mr. Fairbairn can only be truly considered as working out practically Mr. Stephenson's "original idea" by the aid of Mr. Hodgkinson's original mathematics.*

An endeavour has been made to trace the "invention" of the tubular bridge to its proper source, and for this purpose the following works have been consulted:—"Mr. Fairbairn," in 2 vols.; "Report of Commissioners on Application of Iron to Railway Structures;" "Truth and Tubes," by Thos. Fairbairn; and the work of Mr. Edwin Clark, in 2 vols., with plates, in folio.

The conclusion arrived at is, that the "invention"—the "original idea," is due to Mr. Stephenson; the subject has been considered as one of invention only, and not as mixed up with the manufacture of the bridge.

Mr. Stephenson said as much as any prudent man could say in giving his evidence (about an untried thing) before the Railway Committee, May 5, 1845†; and at the conclusion of his evidence he might, no doubt, truly have said, in the words of St. Paul, "I have fed you with milk, and not with meat; for hitherto ye were not able to bear it, neither yet now are ye able."

Having brought these observations to a close, the former part of this communication still remains for consideration—viz., at what stage (if any) of an invention can the aid of scientific and practical men be called in without the risk of their claiming to be sole or joint inventors, thereby depriving the first inventor of, perhaps, the only honour he cares about?

I am, Sir, yours, &c.,

R. Prosser, C.E.

Birmingham, Sept. 2, 1850.

TISSUES WOVEN BY CATERPILLARS. BY MR. J. DENISTOUN.

In the earlier part of this century there lived at Munich a retired officer, Lieutenant Hebenstrait, who amused himself by experiments on the means of giving consistency to the gossamer produced by caterpillars, which is occasionally seen blown about in flakes over the fields in Germany, and he was at one time sanguine of rendering it available as a material for ladies' dress. It is said that his plan was to prepare a paste of lettuce or other leaves beat up with butter, and, after spreading it thinly over a smooth surface of stone or wood on an inclined plane, he placed at the lower end a number of chenilles or caterpillars of the proper species. These animals gradually ascended the incline, devouring the paste, and depositing as they proceed a sort of tissue—until the whole surface was uniformly covered with it. He is reported to have produced open work designs by drawing the pattern with a hair pencil dipped in olive oil before the animals begin to work. These I never saw, but I have seen one veil on which were some letters exactly resembling a watermark on paper, the secret of which I do not know. The inventor pursued his experiments with great secrecy, in the hope of turning his invention to valuable account; but finding this impracticable, it appears that he produced but very few specimens, which are now preserved in various museums on the Continent. I have seen two besides my own, which I procured at Munich, in 1837, after having advertised for it several months. The objections to using this tissue seem to be chiefly its exceedingly flimsy quality, and its very adhesive properties, which render its management and preservation extremely difficult, attaching itself closely even to the smoothest surfaces, from which it can be separated only by the breath. My veil is about 42 in. by 24 in. One of 26½ in. by 17 in. is said to have weighed only 1½ grain. Another containing 9 square feet is mentioned as weighing 4½ grains, while the same surface of silk gauze weighed 137 grains, and of fine lace 262½ grains. It would seem that the art was in some degree known at an earlier period, and occasionally practised in convents, where coloured drawings on small bits of it are said to have been made. I have seen, in all, four of these on the Continent, and two or three on which impressions from copper plate had been taken,—always of sacred subjects. One of the drawings is in my possession, about 7 in. by 5 in., executed apparently in the last century, and I have seen one dated about 1770.—*Mr. I. Denistoun, Proceedings of British Association.*

* Which original mathematics Mr. Tate has since shown to be altogether wrong. Whatever assistance Mr. Stephenson may have had from Mr. Hodgkinson, Mr. Fairbairn had none; this is clear from the published correspondence on the subject. —Ed. M. M.

† The amount of what he did say, 5th May, 1845, we have before shown to be just nothing at all.—Ed. M. M.

THE DOVER AND CALAIS ELECTRIC TELEGRAPH.

An accident has unfortunately taken place, which will cause a temporary suspension of the electro-telegraphic communication so happily established between England and France, as announced in our last. The fact has been made known to the public by the following circular to the newspapers from the Directors of the Company, with whom the Messrs. Brett are associated:

Sir,—"The very general interest which has attached to the successful results of our experiments here during the last week,—induces us to give to the public the intimation that the telegraphic communication between the two countries is temporarily suspended, in consequence (upon examination) of an injury sustained by the wire on some sunken rock off Cape Grisnes. This circumstance, however, is of the less importance, inasmuch as some weeks must otherwise have necessarily elapsed before the communication between London and Paris would have been rendered complete, without which the line would be practically of little use, while the experience which has been gained of the nature of the coasts and the obstacles to be contended with will conduce, in repairing the present injury, to the avoidance of a similar catastrophe and the selection of a safe route for the six permanent wires. The practicability of printing communications from coast to coast in a moment of time having been established beyond the possibility of a doubt, there is no ground for discouragement, and the difficulty now met with (by no means unexpected) will only stimulate to additional exertions, and secure the full completion of an enterprise the first effect of which must be to unite in bonds of common interest the two most powerful nations of the world.—CHARLES J. WOLLASTON, FRANCIS EDWARDS, Directors of the Society."

Dover, September 4.

It will be observed that it is the intention of the Directors of the Company to lay down no less than "*six permanent wires*," so that when this has once been effected, there will be no risk of such an interruption to the communication between the countries ever occurring again (while peace at least endures.)

From a letter which has been published in the *Times* from Mr. J. W. Brett, it appears that "the preparation and laying down" of the wires for the line of communication have been "conducted solely under the management of Mr. C. J. Wollaston, as engineer to the Submarine Telegraph Company."

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING SEPTEMBER 12TH, 1850.

FREDERICK ROSENBORG, of Albemarle-street, Middlesex, Esq., and CONRAD MONTGOMERY, of the Army and Navy Club, St. James's-square, in the same county, Esq. *For improvements in sawing, cutting, boring, and shaping wood.* Patent dated March 7, 1850.

Claims.—1. A machine for sawing wood into pieces or blanks, suitable for being afterwards formed into staves for casks and barrels.

2. Certain peculiar contrivances, arrangements, and combinations by which pieces of wood have first a curvature given to them longitudinally corresponding to that of the staves into which they are afterwards formed, and are then, while in that state of curvature, shaped into staves, each with its required bevel, bilge, and taper.

3. A machine for boring holes in the pieces of wood intended to form the heads of casks, for the admission of dowels for holding the pieces together.

4. A machine for combining a number of staves into the aggregate shape and form of a cask or barrel.

GERARD JOHN DE WITTE, of Brook-street, Westminster, Middlesex, gentleman. *For improvements in machinery, apparatus, metallic, and other substances, for the purposes of letter-press and other printing.* (A communication.) Patent dated March 7, 1850.

This invention consists in a method of casting stereotype plates on the periphery of a cylinder instead of on a flat surface, whereby a great saving of time in printing is stated to be effected. An impression is taken from ordinary types by pressing on their faces damped tissue paper, which, when removed, retains the form of the letters, and serves as a mould for the stereotype. The composition found to answer best for casting consists of 85 parts lead, 13 antimony, and 2 parts tin.

An endless sheet of paper is to be employed for printing. This is fed into a machine, and passes between two stereotype rollers, inked by contact with other rollers placed above them, and communicating with a reservoir. The paper, on coming from the printing rollers, is received between two cylinders, the upper one of which has a serrated knife, so arranged as once in each revolution to project and enter a groove cut in the lower cylinder, by which means the paper is partially severed. The paper in this state is received on an endless band working round two sets of drums. The set furthest from the cutting cylinders are of greater diameter, and necessarily revolve with an increased velocity. Sufficient power is obtained by the increased velocity to sever the filaments by which the partially-cut sheets adhere to each other; each sheet is then delivered separately from the drums.

The machine may be so modified as to print paper-hangings, and other articles requiring an impression on one side only. In such case, inking rollers and reservoirs for each distinct colour will be requisite.

Claims.—1. The construction of cylindrical stereotype plates, as described.

2. The application of the machine described to the printing of paper on both sides.

3. The application of machinery, as described, to the purpose of printing paper hangings; and the employment of a cylinder having a serrated knife or cutting instrument affixed thereto.

William M'Naught, of Rochdale, Lancashire, engineer. *For certain improvements in steam engines, also improvements in apparatus for ascertaining and registering the power of the same.* Patent dated March 7, 1850.

These improvements consist—

1. In forming grooves in the higher and lower points of the steps of the cam by which the expansion steam-valve is worked, so that the rollers upon the end of the expansion valve-rod may take into the grooves; the other points of the steps are left plain. By this arrangement the governor is made to regulate the cutting off of the steam at any part of the stroke. The governor is connected by means of rods and levers with the end of the expansion valve-rod, so that every increase or decrease in the velocity of the governor may cause the rollers of the expansion valve-rod to be either pushed up or down a step on the expansion valve-cam, and thus cut off the steam nearer to the beginning or termination of the stroke.

2. Of an improved piston valve. Instead of moving longitudinally in the case, as such valves have hitherto done, this valve is made to oscillate or to revolve, the ports being adapted to such motion.

3. Of a means for regulating or equalizing the power developed from expansive engines in which the steam is cut off near to the commencement of the stroke. An arrangement of levers is connected with the beam and parallel motion in such manner that a weight is raised by the levers during the first part of the stroke; this weight acts in opposition to the steam, but after the piston has passed the centre of the cylinder it descends with it, and assists to finish the stroke.

4. Of an instrument for registering the work performed by a steam engine, which is nearly of a similar construction to that known as M'Naught's Indicator.

Claims.—1. The bevelled grooves in the cam for working the expansion valve, whereby the governor is made available for altering the degree of expansion.

2. The oscillating piston valve.

3. The means employed for reducing the strain of the engine nearer to a mean.

4. The registering instrument.

John Tayler, of Manchester, mechanical designer, and Richard Hurst, of Rochdale, in the same county, cotton spinner. *For certain improvements in and applicable to looms for weaving, and in machinery or apparatus for preparing, balling, and winding yarns.* Patent dated March 7, 1850.

The patentees describe and claim,

An arrangement of the crank or slay-arms, or an equivalent motion derived from an eccentric cam or tappets, whereby the reed is maintained in its place during the picking up and transmitting of the shuttle, and released when the transit of the shuttle is completed. This arrangement is also applicable to the stop-rod, in order to prevent undue pressure on the shuttle.

The employment of a supplementary spring catch and lever for the purpose of limiting the recoil of the cloth beam when the driving and detaining catches of the taking-up motion are lifted out of gear.

The employment and application of caoutchouc or Indian rubber to the back of the reeds or reed-boxes, whereby additional elasticity is obtained.

Arrangement of self-acting mechanism, for the purpose of changing the shuttles in looms.

Combination of a conical clutch and break applied by recoil of the spring handle for the purpose of stopping the loom when detached from driving shaft.

Communication of driving motion by means of tangent surfaces of vertical and parallel cylinders, pulleys, or drums.

A modification of the preceding arrangements wherein tangent conical surfaces are employed.

A method of stopping beaming looms on the breakage or failure of any of the ends or threads.

The employment of a cam to pass the balling spindle through the series of angles which it is required to make with the plane of motion of the arm; a contrivance whereby an alternate motion of the spindle in opposite directions is obtained; and balling warps on horizontal spindles.

Richard Holdsworth, of the firm of Holdsworth and Co., cotton-spinners, and William Holgate, engineer. *For improvements in apparatus and machinery for warping worsted, cotton, and other fibrous materials.* Patent dated March 11, 1850.

The novelty of this invention consists in the employment of two or more friction surface plates or couplings, whereby motion is communicated to looms, the motion reversed, or the driving shaft put in or out of gear. These friction plates are fixed on a shaft, to which motion is communicated from a prime mover. Between the plates sufficient

space is left to admit a friction bowl attached to the driving shaft. This shaft is supported by a framework, in the top of which works a hand wheel attached to a screw communicating with the shaft; by turning the wheel, the bowl is brought in contact with either the upper or lower plate, whereby motion is communicated or reversed; and when the screw is so adjusted as to bring the bowl between the plates, but touching neither of them, the driving shaft is put out of gear.

The patentees do not claim any of the separate parts constituting this mechanism, nor do they confine themselves to the above details, provided the peculiar character of their invention be retained; but they claim

The application and combination of the mechanical contrivances above described to the purposes mentioned.

WILLIAM CHURCH, of Birmingham, engineer. *For certain improvements in machinery or apparatus to be employed in manufacturing cards and other articles composed wholly or in part of paper or pasteboard, part or parts of the said machinery being applicable to printing the the same, and parts to other purposes where pressure is required.* Patent dated March 7, 1850.

The first of these improvements relates to the hydraulic presses commonly employed in the manufacture of cards, for compressing the paper of which they are formed, and consists in increasing the workman's power of leverage by lengthening the lever at each stroke of the pump rod. The lower side of the lever has a ratchet edge which takes into a cog wheel deriving its impulse from a ratchet wheel moved by a lift, which, as the pump rod rises, strikes against a projecting piece in the framing, and produces thereby a partial revolution, which causes a corresponding elongation of the lever.

The patentee next describes a machine for cutting card-board into strips. It consists of two rollers, each furnished with annular cutters, the distance between which regulates the width of the slip. The board is fed-in from a table, and pressed laterally against a guide-piece, to ensure an even cut. The ends of the rollers have attached to them cog wheels which take into each other, and a third wheel, turned by a handle, serves to give motion to them both. This machine may be actuated by manual labour or steam power; in which latter case one end of the driving-wheel shaft must be furnished with a fast and loose pulley.

A third improvement consists of a machine for cutting board into cards, which has sets of cutters fixed at right angles to each other. The card is first cut into strips, which then, by the action of a stop fixed on an endless chain, have a sidelong direction given them towards the second set of cutters, by which the operation is completed. To prevent the slips riding over each other, a bar is so contrived as to press lightly on the strips without causing friction sufficient to impede their progress.

The patentee further describes a machine for making railway tickets, by which they are cut and dated at one operation;—a machine for numbering tickets, which may, by the alternate action of wheels, on the peripheries of which are fixed figures, be applied to the purpose of consecutive numberings;—a machine for counting the tickets, which, by striking a bell at the completion of every 100, warns the attendant to remove them to make way for a fresh supply;—a machine for paging books, or other sheets or cards requiring to be numbered consecutively; and, lastly, an improved construction of roller for the supply of ink to the types employed in any of the above-named operations.

Claims.—1. The improvements in hydraulic presses, by which an increased power of leverage is given at each successive stroke of the pump rod.

2. The machine for cutting cards into strips, as described.

3. The construction of a machine for forming strips into cards, by means of cutters placed at right angles, and also the employment of the endless chain.

4. The machine for making, dating, and cutting, at one operation, railway or other tickets, and the application of the counting-apparatus.

5. The machine for numbering, which is also applicable to numbering consecutively, and printing address cards.

6. The construction of a machine for paging or numbering consecutively leaves of books, &c.

7. The improved construction of inking-roller.

HENRY JAMES TARLING, of Bayswater, Middlesex, commission agent. *For improvements in the manufacture of fuel and manure, and deodorizing and disinfecting materials.* Patent dated March 7, 1850.

The improvements in "the manufacture of fuel" consist in employing refuse tan, which is to be well mixed with gas tar as it comes from the works, in the proportion of one bushel to a quart of tar. The fuel is then ready for use, or it may be moulded into bricks, if preferred. Instead of tan, peat may be used in the same proportion, and rosin, or rosin oil, may be substituted for the tar, in which case one pint to the bushel of tan or peat will be sufficient.

In the manufacture of "manure," the

patentee employs highly-carbonized refuse tan and night-soil in equal parts. The prepared tan acts as a disinfector, both in the case of its use with night-soil and in other applications thereof.

The patentee does not claim the exclusive use of tan or peat for fuel, as he is aware that they have been previously employed in combination with other materials, but he considers the application of tan and peat, combined with tar or rosin, or rosin oil, as above described, to be new; without, however, confining himself to the exact proportions above given.

Claims.—1. The application of highly-carbonized refuse tan and night-soil for the purpose of manure.

2. The employment of the tan charcoal for the purpose of disinfecting and deodorizing night-soil and other materials.

JOHN TEBAY, of Hackney, Middlesex, C.E. *For an improved meter for registering the flow of water and other fluids.* Patent dated March 7, 1850.

This meter consists of a screw-propeller wheel placed in a channel through which the fluid is made to flow; the axis of the screw-wheel is connected with a train of wheel work by which the quantity passing through the channel is registered.

Regulating and check valves are also employed, for the purpose of ensuring greater accuracy. These valves, together with the screw-wheel, and a means of stopping the flow of the fluid by increasing the pressure of the air inside the meter, constitute the subject matter of the claims.

WILLIAM BROWN, of Airdrie, Lancashire, electrician, and WILLIAM WILLIAMS, the younger, of St. Dennis, Cornwall, gentleman. *For improvements in electric and magnetic apparatus for indicating and communicating intelligence.* Patent dated March 7, 1850.

The patentees describe and claim a method of and apparatus for producing a step-by-step motion by magnets or electro-magnets.

The obtaining of electric currents by induction on electro-magnets formed of iron or nickel charged with voltaic electricity.

A method of signalizing by means of sounds, and of sounding alarums.

A method of protecting the conducting wires of electric telegraphs by strands of hemp put on by a braiding engine, and then coating the whole with gutta percha.

A method of connecting the transmitting wires by screwing one end of a wire into a nut formed on the corresponding end of the next wire.

JOHN FOWLER, jun., of Melksham, Wilts, engineer. *For improvements in draining land.* Patent dated March 7, 1850.

The patentee describes an improved subsoil plough, in which the coulters may be so arranged as to form a furrow for the reception of square or angular drain or manure-conveying pipes. To the back part of the framework is attached a rope, which may be passed through a number of drain pipes and fastened in a knot at the end, by which means, the plough, as it is moved forward, draws the pipes into the furrows. He next describes a machine for cutting and boring wooden pipes, both of a circular and angular form. And, lastly, he proposes to effect drainage by means of heather twisted into the form of a rope, and drawn into the furrows in place of pipes.

Claims.—1. The improved sub-soil plough for draining, and the arrangement of the coulters to form a furrow, into which square or angular drain pipes may be introduced.

2. The machine for sawing and boring wooden pipes.

3. The application of heather to the purpose of draining, as described.

THOMAS IRVING HILL, of Clapham, Surrey, gentleman. *For certain improvements in the treatment of copper and other ores, and obtaining products therefrom.* Patent dated March 9, 1850.

These improvements apply principally to the smelting of refractory copper ores, and consist in the employment of a flux composed of Galena (sulphuret of lead) and baryta, or sulphate or carbonate of baryta In place of baryta, carbonate or sulphate of strontia may be substituted. The proportions are one-tenth galena and nine-tenths baryta, &c. The flux is to be added to the metal in the roasting furnace in the proportion of one-eighth flux to seven-eighths of ore yielding 12 per cent. of copper.

Another improvement is the employment of oxygen gas, to increase the heat and cause more perfect combustion of the coal. Retorts are fixed near the furnaces, in which the gas is generated by exposing therein black oxide of manganese to intense heat. The gas evolved passes to a receiver, and thence by pipes to the fire, either through holes cut in the side or over the bridge of the furnace.

The patentee also employs carbonate of baryta as a flux for iron ore, and introduces oxygen gas to assist combustion, as above described.

Claims.—1. The employment of galena, or sulphuret of lead, in combination with baryta, or carbonate or sulphate of baryta, or carbonate or sulphate of strontia, as a flux for copper ores, as described. Also the generation and application of oxygen gas for increasing heat in smelting and roasting furnaces, as described.

2 The employment of carbonate of baryta as a flux for iron ore. Also the application of oxygen gas, as described.

WILLIAM BENSON STONES, of Golden-square, Middlesex, Manchester warehouseman. *For improvements in treating peat and other carbonaceous and ligneous matters so as to obtain products therefrom.* (A communication.) Patent dated March 7, 1850.

Claims.—1. A machine for compressing peat.

2. A process of carbonizing.

3. The application of carbonic acid gas to the extinction of glowing char-peat.

4. The employment of peat-gas produced during the operation of carbonizing, for the purpose of heating the retorts.

5. The application of a series of receivers to the distillation of the residuum, and the obtaining products therefrom.

6. A process of obtaining "peatole" and "peupion" by rectification.

7. A process of obtaining "peatine."

8. The application of sulphur and peat to the manufacture of bisulphuret of carbon, and application of the peat and sulphur residuum to the manufacture of gunpowder.

9. The manufacture of artificial fuel from anthracite and char-peat.

10. The impregnation of surface-peat with resin oil, &c., for the manufacture of fire-lighters and revivers.

11. The purification of peat gas, as described.

12. The obtaining of heat and light by the combustion of peat gas in atmospheric air, when a coil or plate of platinum is employed.

13. A peculiar construction of gas-burner, and application of these burners for the purpose of blow-pipes, &c.

WILLIAM CRANE WILKINS, of Long-acre, Middlesex, engineer. *For certain improvements in ventilating, heating, and lighting; in lamps and candlesticks; in the manufacture of candles, and in the apparatus to be used for such purposes.* Patent dated March 11, 1850.

Claims.—1. Several descriptions of ventilators for ventilating buildings.

2. Certain modes of constructing chimney-tops.

3. A particular method of heating portable stoves with gas and oil, for the purpose of heating apartments; and also the employment of reflectors in combination with such stoves for heating and lighting purposes.

4. A perforated hollow cone for supplying air to the interior of common grates, for the more perfect combustion of fuel.

5. The construction of Argand gas-burners, by coating them with tin or zinc—by galvanic or other processes, for the prevention of oxidation.

6. A method of regulating the access of air to gas-burners.

7. Certain methods of constructing fish-tail gas-burners.

8. Various constructions of regulators for the purpose of equalizing and regulating the passage of gas.

9 and 10. Certain means of constructing pendent sliding gas lamps, oil pendent lamps, and burners.

11. Several methods of constructing oil body lamps.

12. Certain particular means of constructing railway carriage lamps.

13. Certain constructions and arrangements of spirit and vapour lamps, and also of the parts of spirit and vapour lamps.

14. A syphon-exhausting apparatus to oil and gas lamps and burners.

15. Different forms of illuminators.

16. Various means of constructing candle lamps, and parts of candle lamps.

17. A mode of lighting marine floating-buoys.

18. A mode of covering metallic reflectors with coloured enamel surfaces (silver lustreing.)

19. Burning hydro-carbon with the flame of oil lamps. And

20. A method of manufacturing candles.

RICHARD ARCHIBALD BROOMAN, of the firm of Messrs. J. C. Robertson and Co., of Fleet-street, patent agents. *For improvements in types, stereotype plates, and other figured surfaces for printing from.* (A communication.) Patent dated March 7, 1850.

This invention consists in covering or coating the surfaces of types, stereotype plates, or other printing surfaces, with some protecting metal which will increase their durability without impairing their sharpness.

The metal found to answer best for this purpose is copper, which is precipitated on the types by the agency of galvanic electricity.

Claim.—The covering, coating, or plating the surfaces of types, stereotype plates, and other figured surfaces for printing from, in whole or in part, with some protecting and preserving metal, as before described.

RICHARD CARTE, of 38, Southampton-street, Strand, Middlesex, professor of music. *For certain improvements in the musical instruments designated flutes, clarionets, hautboys, and bassoons.* Patent dated March 7, 1850.

Claims.—1. The employment of certain modes of shutting the keys D and G.

2. A mode of producing the notes D natural and C sharp on the concert flute and the corresponding notes on the tenor flute and other flutes, and also on hautboys.

3. An improvement in the concert flute, before described, whereby, upon pressing down the second, and raising the first and third fingers of the left hand, the C natural and B natural holes are left open to produce the note C natural, and the application of the said mode to the corresponding notes on the tenor flute and other flutes, and also on oboes or hautboys.

4. A certain mode of producing the note F natural by closing the F sharp note by means of the little finger of the left hand, and leaving disengaged the second and third fingers of the right hand, and the application of the said mode to the corresponding notes on the tenor flute, and other flutes.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Pierre Erard, of Paris, for improvements in the construction of piano-fortes. September 12; six months.

Robert Langdon, the younger, of Derby, glove manufacturer, and Thomas Parker Tabberer, of Derby, aforesaid, manufacturer of elastic fabrics, for improvements in the manufacture of looped fabrics. September 12; six months.

Astley Paston Price, of Margate, Kent, chemist, and James Heywood Whitehead, of the Royal George Mills, Saddleworth, near Manchester, for improvements in filters. September 12; six months.

Thomas Lucas Paterson, of Glasgow, North Britain, manufacturer and calico printer, for certain improvements in the preparation or manufacture of textile materials, and in the finishing of woven fabrics, and in the machinery or apparatus used therein. September 12; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Sept, 6	2429	Hugh Booth	Swinton, Lancashire	Fork for the weft stop motion used in looms, or machinery for ma-manufacturing woven fabrics.
7	2430	William Craig and Isaac Whitesmith	Glasgow	Brake for slubbing and roving frames.
9	2431	Lewis Cooke Hertslet	Fitzroy Park, Highgate	Double socket-joint for connecting tubes, or pipes without flanches.
,,	2432	Leman Zox	Long-acre	Cape, or cloak, with hood for travelling or walking.
,,	2433	James Isaacks Sands, and Henry Edward Outtram	Holborn-hill	Self-supporting trousers
10	2434	George Wolstenholm	Sheffield	Doubly carbonised I. X. L. razor.

CONTENTS OF THIS NUMBER.

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Edited by J. C. Robertson, 166, Fleet-street.

PULVERMACHER'S PATENT ELECTRO-MOTIVE ENGINE.

Fig. 1.

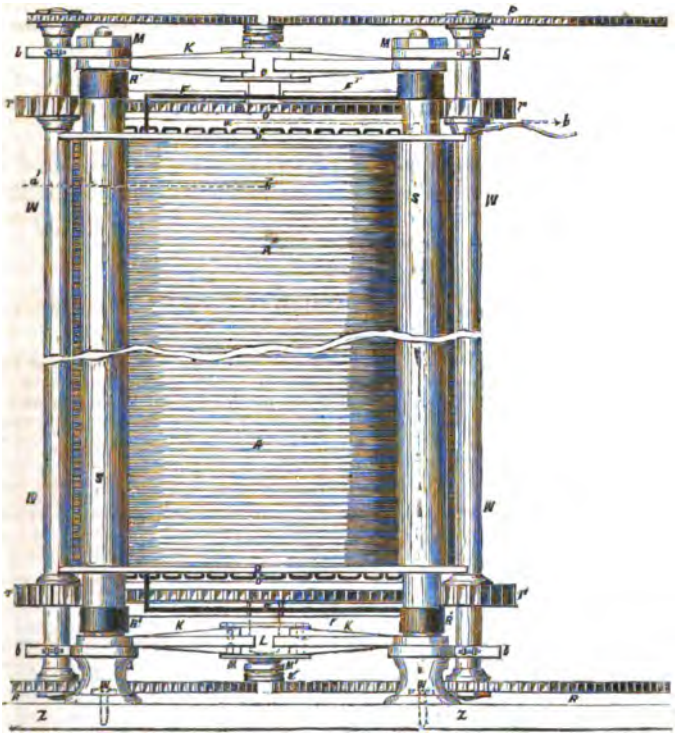
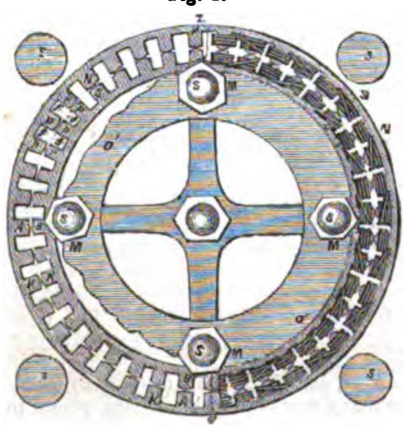


Fig. 4.



PULVERMACHER'S PATENT ELECTRO-MOTIVE ENGINE.

We gave at the time of the enrolment of Mr. Pulvermacher's specification (vol. LII. p. 494), a statement of various improvements made by him in the practical application of the electric and magnetic forces to motive and other useful purposes; some of which have since attracted no small degree of attention for their novelty and ingenuity. We now propose to lay before our readers Mr. Pulvermacher's description, in full, of his electro-motive engine, in which it may be remembered a single galvanic battery is combined with a numerous series of annular electro-magnets. Fig. 1 is an external elevation of the principal part of this machine; fig. 2 a separate elevation of the electro-magnets as combined together in the inner cylinder of the machine; fig. 3 is a sectional elevation of the parts shown in fig. 1, and fig. 4, a plan of two of the rings shows the position which they occupy in relation to one another.

Description.

The electro-magnets are formed of a double series of toothed or notched rings; AA and BB formed of thin plates of soft iron, one set or series being placed inside the other. The outer rings A are toothed upon their inside edges, and the inner rings, BB, toothed upon their outer edges. The number and positions of both sets of teeth or projections correspond to each other, as shown in fig. 4. SS are pillars by which the fixed parts of the machine are bound together, and to the bed plate, or foundation Z. WW is the main shaft of the machine, which has its bearings in bosses L^1 L^1, formed in crosses or frames KK, which are affixed to the pillars SS. These pillars SS, carry two strong plates of metal OO, between which the whole set of outer rings AA, are firmly held together. Every ring is separated from, or has interposed between it and the next ring, a ring of exactly the same form, but made of brass, gutta percha, or some other non-magnetic material. The inner rings BB, are combined in a similar manner and held together by means of two strong discs of metal O^1 O^1, and the bolts S^1 S^1. Both sets of rings, AA and BB, in their combined state, are made as nearly truly cylindrical as possible by being turned after they are fixed in their positions; the outer rings being turned on their inner edges, so that when the one cylinder is placed within the other they may just run clear without the teeth or projections of the one touching those of the other. The bosses of the cross frames, KK, are provided with screws S^2 S^2 (shown in fig. 3), and pinching nuts, M^1M^1, by which the inner cylinder, composed of the rings, BB, may be adjusted lengthwise, so that the iron rings upon it may fall exactly opposite to the iron rings of the outer cylinder; in which position they are shown in fig. 3. Insulated copper wires, *dd*, are coiled round the teeth or projections AA and BB of both sets of rings, care being taken to coil the wires in such a direction that when a galvanic current is sent through them it shall be compelled to follow the course indicated by the arrows in fig. 2; that is, so that the current flowing down the two sets of wires in any one of the grooves or furrows formed by the teeth shall be in the same direction, whereby the currents will be prevented from producing any injurious effect upon each other. To effect this, the wires are crossed from the bottom of one tooth to the top of the other, as shown in fig. 4, and to this crossing of the wires particular attention must be paid, as the course of the current must be so disposed that while it produces a north polarity in all the teeth of one row of teeth, it shall produce a south polarity in the next row. The whole of the rows of teeth or projections, both on the outside of the inner cylinder and the inside of the outer cylinder, are, in fact, transformed into so many rows of electro-magnets (that is, when a galvanic current is sent through the coils of wires by which they are surrounded), and each row has a different polarity from that immediately next to it. The polarity thus produced in the electro-magnet of the inner or moveable cylinder always remains the same, but the polarity of those upon the outer, or fixed cylinder, is changed progressively by the rotation of the machine, acting upon an instrument termed "a pole changer," which is constructed so that a pair of metallic rollers, placed in the electric circuit,

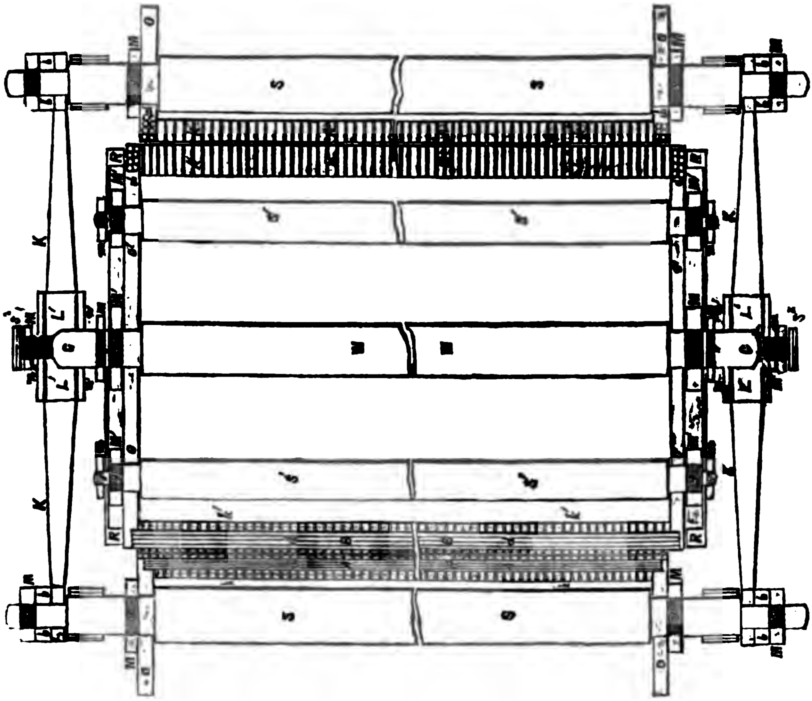


Fig. 3.

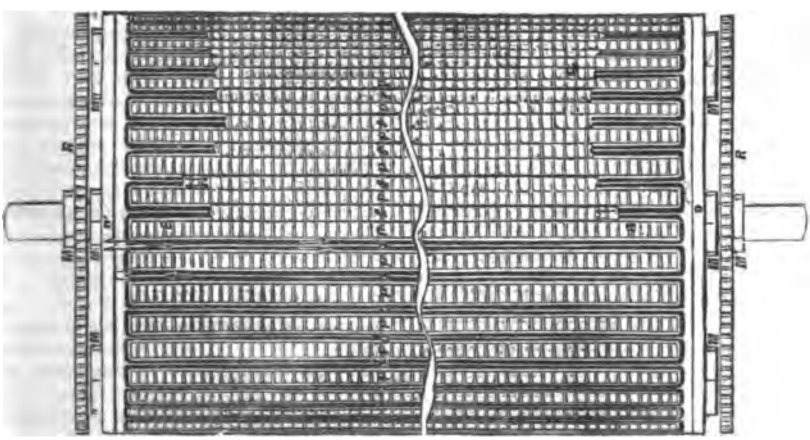


Fig. 2.

shall by passing over a graphite disc reverse the direction of the current alternately. Sometimes I form the rings of tinned iron, or have them tinned after they are cut out, and when they are accurately placed together they are subjected to a temperature sufficient to melt the tin, by which they are formed into one solid mass; but each ring will still form a distinct series of electro-magnets, when subjected to the electric current.

MEMOIR ON THE VARIOUS METHODS ADOPTED AND PROPOSED FOR THE PRESERVATION OF TIMBER. BY M. S. B.

A correspondent, "T. P. J.," of this Magazine, has given a very useful summary of Mr. Paton's observations respecting the *teredo navalis* and other sea worms, and of what is otherwise known of these destructive moluscs, as also considerable information respecting the protection of wood from their ravages by means of creosote or oil of tar; but valuable as is his paper, it does not seem to militate against the making farther experiments respecting the preservative powers of oils other than that of tar; but as oil of tar, indeed all oils, greatly increase the inflammability of wood, as noticed by "T. P. J.," some other means of preserving it must under certain circumstances be had recourse to, and the subject seems of sufficient general importance to justify a farther investigation of it. Perhaps a short statement of much that has already been done towards the conservation of timber may not be unacceptable to the readers of this Journal—of what also has been suggested on the subject—and what, it would appear, still remains to be ascertained for the attainment of this desirable end.

To go back to long by-gone times; it appears that about the year 1784 Colonel Congreve, then at the head of the laboratory at Woolwich, attended as an ordinary pupil a four months' course of the daily chemical lectures of Dr. George Fordyce, which led to intimacy between these gentlemen, and to their discussion of the imperfections of gunpowder as then manufactured. Amongst many chemical defects of the materials used in its composition were those of the charcoal, whether burnt in the usual manner, or in iron pots as at Faversham; Dr. Fordyce discovered the cause of these imperfections, and invented a mode of preparing charcoal by distillation in close vessels; in the apparatus he devised for this purpose, the oil of tar, as it came over from the charcoal cylinders, was collected separately from the pyroligneous acid, and he recommended that the wooden sheds, &c., at the Ordnance premises should be paid with this oil of tar—the first occasion, it is supposed, on which oil of tar was used for such a purpose. Dr. Fordyce had also employed his chemical knowledge in preventing and checking dry-rot, and had found that sulphate of iron was as efficacious for this purpose as the more costly sulphate of copper, which had previously been recommended by Dr. Hales for the preservation of wood. The average duration of negro houses on the estate of Richard Atkinson, in the island of Jamaica, when built of unprepared wood, had been little more than two years, whereas those of which the wood had been prepared according to Dr. Fordyce's instructions with sulphate of iron, were still in a good state after the lapse of ten years. Dry-rot attacked seriously the wooden frame of a window in his own house; he caused the decayed parts to be scraped out as far as practicable without injury to the exterior shell, and the remaining part to be saturated with a solution of sulphate of iron, whereby spread of the dry-rot was completely checked; and the same good effect resulted wherever the same solution was, at his suggestion, employed in other houses. In the same room used as an Observatory, which had been attacked by dry-rot, the floor was riddled by a small species of beetle; he had the boards washed with a solution of corrosive sublimate, which destroyed the insects, and preserved the floor from future attacks.

Letters written from Amsterdam by Sir Samuel Bentham in the year 1779, testify that his attention had already been particularly directed to the preservation of timber; that a peculiar process for effecting the purpose was practised by the Messrs. May of that city, and that our Ambassador at the Hague, Sir Joseph Yorke, had communicated to the Admiralty indications of the means they employed habitually to preserve the timber of ships of their build; this mode was ordered to be tried in our Royal Dockyards by order of the Admiralty, but the experiments were ill-conducted, as so often happens in those establishments; a change of administration took place, and the intended prosecution of the experiment was lost sight of. Sir Samuel during his tour after information, and long sojourn in different parts of Europe, and of Russia in Asia, seems never to have neglected opportunities of obtaining information respecting the preserva-

tion of wood, and on his return to England, in 1791, he further prosecuted his inquiries on the subject. It appeared that in this country no progress whatever had latterly been made, in improving the means either of seasoning timber or retarding its decay, but he was himself convinced of the efficacy of impregnating it with various matters as preservatives; the only difficulty was as to the mode of introducing them. He had in Russia experienced the obstacle presented by air contained between the fibres of wood to the introduction of any fluid: how could this impediment be overcome? Air being the resistance, why not, he reasoned, withdraw the air by some such apparatus as the air-pump? Then, generalising the idea, he perceived that an immense variety of manufacturing operations might be facilitated by performing them *in vacuo*. Reflection confirmed him in this opinion; and the consequence was that in 1794 he engaged a person, in the habit of experimenting, to make several trials on a small scale, to ascertain what advantages might practically be obtained by the abstraction of air in many manufacturing processes. With this view he contrived, and had many adjuncts to a good ordinary air-pump, whereby many particulars requiring practical confirmation were verified. Success even exceeded his hopes, and in consequence he patented his invention January 24, 1795. His specification set forth that, "The invention consisted in the idea of applying to the purposes of art and manufacture in the large way the practice which has been so long in use of extracting and excluding the air in the way of philosophical experiments." He divided the cases to which a vacuum is applicable under general heads: "1. Preservation in point of substance," and in "point of colour." "2. Distillation." "3. Effectuation of Contact." "4. Intromission into Tubular or other Cavities." "5. Impregnation." "6. Transmission and Percolation." "7. Mixture." "8. Regulation of Heat." "9. Exsiccation." But promising as were his prospects in regard to this and others of his inventions, he was induced to engage in the public service, and thereby sacrificed the pecuniary advantages derivable from his patents, which are said to have enabled many individuals to have realised immense sums. In regard to the patent in question, for example, by applying a vacuum to a process in the purification of sugar, greater profits are supposed to have been derived, than have ever been known to have been obtained by any other patented invention. Many others are the instances in which the abstraction of air has already been employed in manufactures with success —from the wetting of paper for bank-notes down by the little apparatus for shutting a door, lately exhibited to the scientific meeting at Edinburgh: but this, truly, is irrelevant to the seasoning of wood.

The advantages derivable from Sir Samuel Bentham's patent of 1795, in regard to the preservation of timber, come under the heads of "Impregnation" and "Percolation." Under the head of "Impregnation," the specification runs thus: "By the expulsion of the air, this process may be facilitated in every instance, whatever be the design of impregnation, the nature of the solid to be impregnated, or of the fluid with which it is to be impregnated. So, for example, to the impregnating of any one substance with another, whether in a liquid state or vapour . . . to the impregnating of *wood*, or other fibrous or cellulated masses with any substance for any purpose—for instance, with saline solutions to preserve them from putrefaction and combustion—with oleaginous matters to preserve them from putrefaction—or with poisonous matters to preserve them from corrosion by the sea-worm or other insects."

Under the heads of "Transmission" and "Percolation," the specification proceeded in these terms: "By the same means the process of percolation, or filtration, may be rendered comparatively instantaneous, whether the object in view be the purification of the fluid transmitted, or the purification of the substance through which it is to be transmitted; . . thus also may water, or any other fluid, be driven through . . wood to cleanse it from its putrefiable juices."

"As to the vacuum-chamber or receptacle which is to be exhausted of its air, and into which the subjects of the several processes are respectively to be introduced—the bulk of it will, of course, be regulated by the scale on which it is proposed to operate, like the vessels of a large brewery;—it may

be of the size of a large room. In general, it should be no larger than necessary, since the greater the space left unoccupied by the subject in question, the greater the quantity of air to be extracted. In the same view, there may be an advantage in adapting the form of the chamber in some measure to the form of the subject to be contained in it. Of course, it would not be made in the same shape for a plank of timber as for a barrel of provisions; where flatness is not necessary, convexity will be preferable, on account of the advantage it gives in point of strength."

"In many cases of impregnation and transmission, the fluid which it is intended should be forced through or into the subject matter, finds its intended place already occupied by another fluid, which it must consequently drive out. In these cases an advantageous way of effecting the exchange is, so to order matters that the inclosure of the subject matter in the vacuum chamber shall be partial only, leaving one part exposed to the pressure of the external atmosphere, with no other covering than that of the impregnating fluid. Suppose now the body into or through which the fluid is intended to be forced to be a log of wood, the varieties of which the construction of the apparatus is susceptible, may be comprised under two principal cases; either the whole of the log, one end excepted, will be within the chamber, that end only remaining exposed to the fluid without, or the whole of it, one end excepted, will be exposed to the fluid without, that one end alone being introduced within the chamber. In the first case, the chamber must be large enough to contain the log; in the other case, there must indeed be without the chamber a vessel large enough to contain the log, together with the fluid with which it is to be encompassed; but the chamber itself need only be of such size as to have one of its boundaries large enough for the log to fit into; what the log wants of filling up the aperture thus left in the chamber to receive it, must of course be filled up air-tight at each operation—for instance, by wedges of wood, with a cement."

About the year 1796, Sir Samuel happened to hear that at Boston (United States), a pier or jetty, though of wood, had never been attacked by the sea-worm, the materials having been paid with coarse whale oil: this, in addition to his experience in Russia of the efficacy of the oil of birch-bark in resisting the depredations of insects, induced him to cause experiments to be made at Plymouth, (as mentioned in Number 1282 of the *Mechanics' Magazine*); not considering, however, that these experiments, or any other which had hitherto been made, could be regarded as conclusive, he continued his endeavours to obtain more certain knowledge on the subject—as appears by his official letter of the 27th October, 1797. It was written in obedience to the commands of the Admiralty, that he should give his opinion on a proposal for seasoning timber by means of lime; he recommended a trial of it, but observed at the same time, "that it was by no means certain that that mode of seasoning timber would prove preferable to other modes, which might be found on a *comparative* trial of various means which had already been practised for this purpose, and of others which a more perfect investigation of this branch of chemistry might point out as worthy of experiment;" and that he "had collected together a number of modes which appeared worthy of trial, if their Lordships should think fit that a course of experiments on the seasoning of timber should be instituted." No such set of experiments were, however, authorised at that time, nor have they to this day been undertaken, it is believed, either by Government or by any individual; hence the uncertainty as to which of several modes in use for seasoning and preserving timber, under this or that set of different circumstances, is the one to be preferred, either in point of efficacy or expense.

Sir Samuel did, however, embrace the opportunity afforded him by being given individually the management of the wood-mills in Portsmouth Dockyard, where he fitted up one of the cellars as a seasoning-house, and was prosecuting in it a course of experiments when he was "sent away to Russia." Nothing further seems to have been done on the subject till, in 1811, he officially proposed, for the preservation of a breakwater of wood, that it should be "paid over with oil of tar, or other cheap oil."

Where the preservation of wood from decay, and the rendering of it obnoxious to sea-worms are both attainable by the same means, these of course are usually to be preferred, as for a floating breakwater, for instance: but there are many cases where the depredations of sea-worms have to be guarded against; yet

where the smell of creosote would hardly be tolerated. Could its offensive and long-enduring stench be borne, for instance, at a loading quay and promenade in such a place as Brighton? The emanations from oil of tar are highly injurious to vegetation, therefore it is improper for horticultural erections; so, were all the wood that enters into the construction of a ship to be impregnated with it, the vessel would be intolerable to landsmen—probably even to mariners, accustomed though they be to the smell of tarred ropes; yet there are indications that great economy would result from the impregnation of ship timber with an oil of some sort; this is an inference that may be drawn from the great durability of teak and green-heart, both of them said to contain naturally a great proportion of oil, and both of them said to be free from attack by the sea-worm. From these considerations it was that the further experiments on oils were suggested in this Journal, No. 1406.*

Mr. Paton's published observations on sea-worms prove that poisons have no deleterious effects upon them; the experiments at Plymouth indicate that oil in some way preserves wood from their attacks. Now the object of the experiments suggested was, partly to ascertain whether it was from distatesfulness of that fluid, or from its preventing in some way their means of comminuting wood—partly to ascertain whether cheap oils as a class might be indifferently used as preservatives—not, as seems to have been supposed, from ignorance of the great extent to which oil of tar is now used for both paying railway sleepers, &c., and for their impregnation to a greater or less depth from their surfaces.

The mode of impregnating wood with oil of tar, indicated by "T. P. J.," is that of a pressure of about 150 lbs. to the square inch—ten times the weight of the atmosphere; but no observations are made as to the state of dryness of the wood when submitted to this pressure, though much must depend on this circumstance. The need for this great pressure cannot but arise from the quantity of air and fluids contained in the pores of the wood; therefore it would seem that Sir Samuel's patent mode must be preferred, since, by exhaustion of the air from a receiver containing timber, fluids would be withdrawn along with the air. The apparatus he contrived, and which was used for the experiments he had made of impregnating timber *in vacuo*, consisted of a vacuum chamber capable of containing the piece of wood to be saturated, and of a cup-shaped cover, in which the upper end of the piece of wood experimented on was fixed air-tight; this cup was filled with the liquid to be forced into the wood; air was then exhausted from the vacuum chamber, fluids contained in the wood accompanied the air, and both were replaced with the liquid from the cup by atmospheric pressure. A great number of experiments were made before he applied for his patent; amongst them, several to ascertain the degree of uniformity with which dies in solution would penetrate wood; solutions of sulphates of copper and of iron were tried, infusions of Brazil wood and logwood, as also of gallic acid, followed by sulphate of iron, to produce black. The wood so treated, when split open, was always found uniform in colour throughout.

The pressure "T. P. J." mentions being about ten times that of the atmosphere, it follows that the apparatus his mode requires, must be ten times more powerful than that by which a vacuum may be obtained: but the necessary apparatus for either the one or the other mode, can only be worth erection in great establishments; and, indeed, it appears that an almost superficial coating of some preservatives has sufficed for the conservation of wood. It is not likely that the pier at Boston was impregnated to any considerable depth with oil. Mr. Jenner, at Plymouth, certainly had no other means of coating wood with oil than that of laying it on with a brush in common use in the dockyard; so the wood of Sheerness was paid in the usual way with common brushes. A mode in which oil of tar is used very commonly for the preservation of railway sleepers, and of the posts for the electric telegraph, is

* By some mischance a press error crept into one paragraph of that communication; the word "it" being printed in lieu of *oil*, where it was intended to be said, in speaking of sea-worms, that *oil* "may be either distasteful to their palates or may be incompatible with their means of comminuting wood so as to prepare it for food."

that of dipping them in oil of tar, then holding them over a fire of chips and shavings till the sleeper or post itself is inflamed; this burning is continued till the wood is charred exteriorly—the tar being at the same time driven to a greater or less depth into the substance of the wood. These examples and these practices are encouraging for persons not having access to great manufactories, yet desirous of preserving a park fence or a few posts driven into the ground, or what not, in a little way. The oil of tar employed in this last-mentioned way is the cheap coal-tar from gas works, which seems to be coming into general use by carpenters, &c.

(*To be concluded in our next.*)

ENGLISH AND AMERICAN STEAM-SHIP BUILDING.—OCEAN NAVIGATION.—THE CUNARD AND COLLINS' LINES.

Sir,—The publication of certain facts and drawings, in Nos. 1398 and 1408, relative to the rival steam-ships of the Cunard and Collins' Transatlantic Lines, induce me to address you as heretofore, under the same signature, which, though anonymous, shall, I trust, be supported by facts and figures sufficient to neutralize that disadvantage.

And I may state my reasons for this course. I do not wish to make your pages a vehicle for personal renown or professional advancement. I shall rigidly adhere to the truth, to the best of my belief, and utterly repudiate any personal allusions or antipathies. I should prefer to remain unknown; but I authorize you to give up my name to any one who, in your judgment, may require it for proper purposes.

The subject of my remarks, and to which I earnestly desire to draw the attention of your readers, of the public, and particularly of English engineers, is the merits and demerits of the two systems of engineering adopted in the vessels of the Cunard line, which have been built and manufactured in this country; and in those of Collins' line, the production of our brethren in the United States. Both are excellent in their way, and each, in the absence of the other, would have been—indeed has been—considered perfection; but competition, and a very proper and laudable rivalry, has shown which of them it is best and most desirable to adopt in extending Atlantic steam navigation.

They have shown this to a certain extent, but no more. Neither of these lines of steamers (as it respects their machinery) have developed the highest state of engineering knowledge now and for some time past existing in this country. Humiliating as it may be, to British engineers to acknowledge that they are beaten, although by their next of kin, it is tolerably certain that we shall have to make that admission; and your intelligent correspondent in No. 1398, prophecies this: to the best of my belief this will be so, has been so, and it is capable of very easy proof why it should be so.

But, that it could not have been otherwise, I utterly deny. I assert, that means are known to us by which both these systems (and they differ but in small degree) may be immeasurably excelled, at a much cheaper outlay, diminished cost for repairs, both in engines and ships, and a far more efficient result in all respects; and that this is not only practicable, but has really become an acknowledged fact, it shall be my object to establish.

Steam engines are of various constructions and meçhanical arrangements;—in *principle*, they are as left to us by the immortal Watt. Modern necessities and ingenuity have introduced many deviations from his plans, and, as might be expected from extended practice and experience, with good result. Mr. Watt left us the "beam" or "side-lever" engine—excellent in its way, and suitable to his time (it has many votaries even now); others have introduced the "direct engine;" others, tubular boilers in place of *flue* boilers; others, feathering or eccentric paddle-wheels, in lieu of the common radial wheel.

Cunard's vessels possess none of these improvements;—they have beam engines, flue boilers, and radial paddle-wheels.

Collins' vessels have beam engines and radial paddle-wheels; but the boilers are partly tubular, and *alone are the cause of their superiority over their competitors.* This has been so ably shown by your correspondent already quoted, in No. 1398, page 402, that I do not think it either necessary or

just to occupy your space with further proof than to observe, that the great evaporative power of the boilers, and the extended grate surface (a capacity to consume fuel with economy), must be conclusive to the minds of all professional men, and that all other things being the same, we must succumb. We must "go-ahead" again by merely availing ourselves of the means we possess, and we assuredly shall be triumphant in a superlative degree.

This is matter of grave import for the consideration of those whose pecuniary interests are connected with the Cunard line of steamers; it is still more of importance to another great and flourishing Company, of whom I shall speak hereafter, but whose infatuation and error is so utterly unaccountable, when we reflect that they ought to be—must be—fully aware of the great advantages they might have secured by a more able and discriminating course, which, if taken, would have been the means of placing them at the head of the steam navigation of the world. It will be their ill-fortune to see the great mistake they have made in the spring of 1850.

It must be evident to all men, that small space occupied by steam machinery on board ship, and its minimum weight, compatible with strength and efficiency, must be that which is to be desired. All modern improvement has tended to this end; indeed, diminished weight of machinery is really *power*, for thereby you decrease the *immersion* of your ship, lessen her resistance, and increase her velocity, with a greater capability to carry her cargo and make a voyage remunerative, without additional outlay in fuel.

To do this to the greatest extent there can be no doubt that we must adopt *oscillating or vibrating steam engines*, *tubular* or other improved boilers, and eccentric paddle-wheels.

I have already remarked that Cunard's vessels are fitted with the ordinary main lever engines, common flue boilers, and radial paddle-wheels; the workmanship of the whole is excellent—in fact, it is a splendid piece of mechanism, and, of its kind, perfect. It has also been noticed that Collins' vessels differ only in the construction of the boilers, which are partly tubular; and this, though but a small instalment of our knowledge, is still sufficient to establish a superiority, and therefore powerfully supports the position I have taken, and shall now proceed to make evident and patent to your readers.

The subject may be divided into the three portions already stated; namely, engines, boilers, and paddle-wheels, and these I will take *seriatim*.

I. *Beam engines* are the most ponderous of all constructions now extant. I have before me a list of about 150 pairs of these machines, which, with common flue boilers and water radial paddle-wheels, and coal boxes, average about 23 cwts. per nominal horse power. The weights may be taken as follows, in decimal parts of a ton, and may be useful to many of your readers:—

Engines alone......	=·515
Paddle-wheels......	=·092
Boiler and apparatus	=·310
Water in ditto......	=·207
Coal bunkers	=·031 = 1.155,

or just 23 cwts. per nominal horses power. I believe this to be an average weight of beam engines, &c., as detailed; but, if report be true, the machinery of the Cunard steamers weighs even still more; it is said to be 1000 tons! which, for 800 horses power, is just 25 cwts. per nominal horse!

The superiority of Collins' vessels does not arise from *lighter* machinery, but from the greatly enlarged evaporative power of the boilers, without increase either in weight or space.

Beam engines are very expensive to manufacture. Oscillating engines, at 40*l.* per horse (boilers and paddle-wheels being the same), is a more lucrative order than beam engines at 50*l.* per horse, which will appear evident when we compare the quantity of *material* in the two kinds of engines;—they are more expensive in repairs, use more oil and tallow from the number of the parts, are subject to transverse strains, requiring an enormously strong and heavy bed-plate to counteract the pressure upon the main gudgeon, which has to resist *double* the force of the steam upon the piston.

It is also dangerous to work beam engines under heavy pressures of steam, unless the motive parts are made more than usually heavy and strong—generally 2½ times the nominal power is the usual practice. I know one or two instances

where three times has been obtained, but accidents have resulted, to which they will always be liable; but make the connections as strong and heavy as you please, these engines can never contend in this respect with the direct or the oscillating engine.

The space occupied in the ship is also of paramount importance. Beam engines of 800 horses power will require not less than 35 to 36 feet in the most important part of the vessel. Oscillating engines of the same *nominal* horses power will have ample room in 14 or 15 feet, and they require less than one-half the timber foundation or "sleepers" to erect them upon.

The oscillating engine is self-contained; all its strains are direct—not doubled (as in the main gudgeons of beam engines;) a great number of parts are banished, and simplicity in its integrity duly obtained: the centre of gravity of the whole is lower, and therefore tending to increase the stability of the ship; the wear and tear is less, and, when requiring repair, the cost is small from the few working parts. It may be made to bear almost any pressure by a slight increase in the crank shafts and piston rods. It goes at once to its work, which it does with vigour and certitude—indicator diagrams fully proving a proper effect for every atom of steam that is used.

And, lastly, the *weight* of the oscillating engine is just *one-half* that of the beam engine. A *pair* of oscillating engines, properly constructed (for we have quacks in engineering as well as in medicine), will weigh no more than *one* beam engine.

Taking an average of upwards of 3000 horses power which I have designed, the engines alone weigh just ·253 of a ton per *nominal* horse, or say 5 cwt. only.

Here, then, is a great secret, not so fully known as it should be; and I shall be amply rewarded if I succeed in convincing those of its truth who are so deeply and pecuniarily interested in this question.

It may be as well to insert here the weight of oscillating engines, tubular boilers, and mechanical wheels, which are as follows:—

Oscillating engines	=·253
Patent paddle-wheels	=·110
Tubular boilers, having 16 square feet of absorbent surface per horse power and apparatus ...	=·215
Water in the boilers	=·100
Coal-boxes	=·030
	·708

or just 14 cwt. per nominal horse! and this is not supposition, but what the writer has done with 3000 horses power, and what has been done by Penn for several years past in some of the finest of our men-of-war. The *Retribution* may be quoted, as one instance of the advantages to be obtained.

II. *Tubular boilers* have suffered much in reputation by being made too contracted in the water-ways, the tubes too close together, and the plates not sufficiently strong to resist the increased pressure used in them. They save both in weight and space, and are now designed quite free from the general objections made to them; they are not more expensive in fuel when a due proportion exists between the absorbent surface and the surface of the grates; and I know no reason why they should not be as durable as the ordinary flue boiler; they perhaps require more attention in blowing off, and keeping free from salt and earthy incrustation—that is all.

But the great saving is in the oscillating engine. If tubular boilers are objected to, we can have recourse to double tier flue boilers, which may be made with very slightly-increased weight and dimensions. The following Table will show the great improvements of late years in this branch of marine engineering:—

Years made in.	Per Nominal Horse.	Contents of Boiler in Cub. Feet.	Contents of Steam Chests.	Total Contents.	Area of the Base of Boiler.
1818 to 1840	Ordinary single flue boiler, an average of 107 boilers	20·75	1·75	22·50	2·75
1840 to 1850	Double tier flue boilers, an average of 20 boilers	14·60	1·90	16·50	1·29
1840 to 1850	Tubular boilers as hitherto made	9·25	2·00	11·25	1·083

Therefore, making an allowance for the proper enlargement of tubular boilers for the purposes of ocean navigation, there will not be found any important preference over the double tier flue boiler.

III. *Eccentric, or feathering paddle-wheels* possess very important qualities; and although I adhere rigidly to the general opinions many years since expressed in print upon these wheels, as *then* constructed; they are now so much improved in manufacture and design as to have become *commercially* useful. They are nearly double the weight of common radial wheels, quite double the cost, and, so far as my experience goes, still give very great trouble and labour to repair. But for ships of variable draught, accustomed to contend with heavy seas, and also as conducive to the comfort of the passengers and crew, they are invaluable, and far beyond their extra cost; therefore I recommend their use for Atlantic navigation.

In a former part of this paper I referred to the Royal Mail Company (West India) who have lately entered into contracts to extend their fleet by the addition of five superb ships of upwards of 3000 tons displacement, having beams of 39 feet, and 270 feet long, drawing 19·6 when fully laden.

I have already expressed my deep regret that this Company should have contracted (with one exception) for the obsolete beam engine—flue boilers—and feathering or eccentric wheels. This they will assuredly regret; but having, I trust, fully shown the advantages to be derived from another course, I will devote the remainder of this paper to show what that Company will attain, and what they might have possessed with a less outlay—how they might have secured the greatest perfection, and how they have left open an opportunity for a vigorous and successful opposition to their earnest and sincere desires to uphold the permanency of their enterprise.

They have contracted for engines of 750 nominal horses power; now, as I have already stated that beam engines at 50*l.* per horse is not so lucrative an order as oscillating engines at 40*l.* per horse; hence they might have saved,

750 horses, at 50*l.* per horse, 37,500*l.*
750 „ 40*l.* „ 30,000*l.*

or 7,500*l.* upon each pair of engines, or in the five ships, no less a sum than 37,500*l.*, or just the cost of one pair of beam engines ! !

I need not say that the interest upon this amount is of some importance; or state the value of this sum as the nucleus of an insurance fund, and which this Company have hitherto found the use of in a more than usual degree. But the most important consideration will be the increased velocities of these ships, had they been fitted with machinery of the most improved and efficient kind.

I have already noted that their new ships are to have beams of 39 feet, and when laden and fully equipped for sea, on starting from Southampton are expected to draw 19 feet 6 inches of water.

The area of the immersed midship section will therefore be about 670 square feet.

We will also allow that the *indicator* power will be 2½ times the *nominal* power, a very full proportion for beam engines to work safely under (unless they are made more than usually strong in the motive parts, as before explained). We therefore have $750 \times 2{\cdot}5 = 1875$ horses power.

It is well known by engineers that the power required to propel ships is as the *cubes of the velocities*, and from an ex-

tended experience, I assert that the mechanical result may be represented by the factor 800, and it will be perfectly correct to take the area of the midship section (in each case) as the exponent of the resistance of the ship. Therefore the velocity will be

$$\frac{\sqrt[3]{1875 \times 800}}{670} = 13{\cdot}08 \text{ miles per hour.}$$

This is, with beam engines of 23 cwt. per nominal horses power, or a total weight of 862·5 tons complete.

I have already shown that oscillating engines may be made to weigh but 14 cwt. per horse, and to exert three times the nominal power, without the slightest increase in the parts, and when so strengthened (an inexpensive process) may be extended to 3½ times the nominal power. Therefore 750 × 14 cwt. = 525 tons, or a saving upon the beam engine of 337·5 tons dead weight!!

The power of the oscillating engine will be 750 × 3 = 2250 horses, and supposing the 337·5 tons on board in the shape of CARGO (paying a heavy freight), the velocity would be

$$\frac{\sqrt[3]{2250 \times 800}}{670} = 13{\cdot}90 \text{ miles per hour,}$$

an increase of 0·82 mile per hour by the superior power of the oscillating engine alone.

But this comparison is faulty, because we have not accounted for the decreased weight of 337·5 tons.

From the magnitude of these ships, each inch of their immersion will be equal to *about* 20 tons. Therefore

$$\frac{337{\cdot}5}{20} = 16{\cdot}875 \text{ inches}$$

decrease in the draft, so that the area of the midship section will be reduced by the lighter but more efficient machinery, from 670 to 614 feet; and using the same formula we shall have

$$\frac{\sqrt[3]{2250 \times 800}}{614} = 14{\cdot}31 \text{ miles per hour,}$$

or an excess over the beam engine of (14·31 − 13·08) = 1·23 miles per hour.

I take from an original prospectus of the Royal Mail Company, the route out and home at 10,500 statute *miles*, and though perhaps not absolutely correct, it will answer my purpose for an illustration of the advantages to be derived from improved machinery.

The *beam* engine will produce a velocity of 13·08 miles per hour—the *oscillating* engine, 14·13 miles (all things being the same). Therefore, this service would be performed by the former in 33¾ days, and by the latter in 30¼ days; and this saving of three days would be accompanied by the *insurance* fund of 37,500*l.*!

On the other hand, presuming that a cargo of 337·5 tons were taken on board, the voyage could be completed in 31¾ days,—a saving of two days, and the freight of the 337 tons of merchandise, which I leave others to set a value upon.

Applying these views and arguments to the Cunard's line of steamers, it is certain that if an average passage is now 11 days, it would become one of 9½ or 10 days at the most.

I may, perhaps, not be fully understood by your general readers; but I recommend this paper to the careful consideration of the profession, and to that of the powerful companies interested in the matter here discussed. You, Sir, know I have no trade-interest in what I write—I am not "looking for a job"—but do not wish to see the day when our pre-eminence as engineers can be called into question.

It would be a curious *finale*, if our brethren in America (far-seeing as they are) were to adopt the improvements now suggested. I believe that will be the result; and if they do, our boasted performances, as they now exist in ocean steam navigation will be entirely eclipsed.

I am, Sir, yours, &c.,

PRESSURE, NOT PUFF.

ON THE COVERING OF WIRE WITH GUTTA PERCHA FOR ELECTRIC PURPOSES.

Sir,—The superior property of gutta percha as an insulator is already widely appreciated by many scientific persons; but it has not to my knowledge been yet employed in covering wires for general experiments (with the exception of the telegraphic experiments at Dover). I have been enabled some time past to coat wires of all sorts very successfully at a rapid rate, and I here beg to submit to

you the plan I adopted. A glass tube, 6 inches long, and 1 inch in diameter, was fixed perpendicularly in a frame; its upper end was left open, while the lower aperture was tightly closed with a cork, up through the middle of which passed the wire to be coated. Then a thick solution of gutta percha was poured in, until the tube was about half-full. The wire was now gradually drawn up through the cork and the mixture, covered along its length with an uniform coating; and its end being attached to a bobbin kept revolving near the ceiling, it was wound into a coil, while the distance between the bobbin and the tube enabled the solution on the wire to dry before it came to the position to be coiled up.

Thus, by employing several tubes and bobbins, it would be easy to coat a great number of wires at the same time, while the trouble, after once putting things in order, would be merely a trifle.

It remains to be seen whether this method is cheaper than the usual way of employing silk or cotton. At any rate, wires coated with gutta percha will be found highly useful in delicate experiments, where an estimation of weak voltaic currents is made; for unless perfect isolation be effected, a feeble electric current may not, from passing through the mass of the wire, be at all indicated by the galvanometer; and gutta percha, as was discovered by our illustrious Faraday, possesses this quality of isolation in a greater degree than any substance yet known. In addition to this, since it is known to possess electric properties no less singular, we may look for its introduction into the construction of electrical machines as forthcoming, and it may be advantageously taken into consideration by your ingenious readers for that and similar purposes.

I remain, Sir, yours, &c.,

D. Jones.

Carmarthen, August, 21, 1850.

THE DOVER AND CALAIS ELECTRIC TELEGRAPH.

We quote from the *Times* the following statement of the circumstances attending the unfortunate interruption to the progress of this undertaking. The accidental rupture of the wire turns out to be not the sole cause. We remarked, in our first announcement of the intended project, that, looking at the legal difficulties in the way, we did not well see how the Messrs. Brett could have secured for themselves and friends the exclusive privilege which they were said to have obtained from the Governments of England and France; and we are sorry now to see our doubts on this head confirmed. What is meant, however, by obtaining "a grant from the French Government of the eighteen miles of line *extending from the coast to Calais, from which point to Paris the wires are erected,*" we are at a loss to conjecture; it reads to us very like nonsense (owing probably to some misprint or verbal omission). Both Governments will, we doubt not, do their utmost to facilitate and encourage so noble an enterprise; but there is more, we fear, in the difficulties to which we have alluded than it is within the competence of the governments themselves to overcome. The concurrence must be obtained of the legislatures of the two countries, and that is not to be had in a day.

We observe that something is said about better protecting the submerged wire. It is to be "incased either in a 5-inch or a 10-inch cable, of the diameter of those that placed the Britannia tubes in position!" How and when was it ascertained that a coating of such prodigious thickness is necessary? This is the first we have heard of anything of the sort. If such were really the case, it would put for ever an end to the whole scheme of submarine electric communication. For, only think what the size must be of a reel with a single mile of five or ten-inch cable wound upon it! (to say nothing of tens and hundreds of miles!)—What the size of the ship required to carry it out and lay it down! But we put no faith in the alleged necessity for farther protection; we believe all that is said on this head to be without the slightest foundation.

Dover, Sept. 15.

Since the sinking of the first wire, circumstances have occurred calculated for a short time to retard the carrying out the project to completion, seeing that, in order to the complete establishment of an integral l[illegible] e of

telegraphic service between London, Paris, and the Continent, the promoters have to obtain a grant from the French Government of the eighteen miles of line extending from the coast to Calais, from which point to Paris the wires are erected. To secure that concession of this section, in the way of which some difficulties present themselves, Messrs. Brett, Wollaston, and Edwards, Directors of the undertaking, are now at Paris, awaiting the return of the President of the Republic, who granted the original decree, and to negotiate with the Government authorities on the subject.

In the meantime, experience of the experiments already made goes to prove that a stronger species of telegraphic tackle will be required. By the terms of contract with the French Government it was enacted—"That the Government does not reserve to itself the right of making any similar concession," but "that in case the experiment shall not result in a favourable execution by the 1st September, 1850, the right conceded will revert to the French Government." Consequent on the conditions laid down in the contract the promoters successfully submerged the wire; but, as is well known, it was subsequently cut asunder by some rocks on the French coast.

Since this happened divers have been down, and on examination it has been found that where the rupture of the coil occurred it had rested on a very sharp ridge of rocks, about a mile out from Cape Grinez, so that the leaden weights, hanging pannier-like on either side, in conjunction with the swaying of the water, caused it to part at that point, while at another place in-shore the shingle from the beach had the effect of detaching the coil from the leaden conductor, that carried it up the Cape. The wire in its gutta percha coating was consequently cut in two places, representing a remnant of wire, of about 400 yards, which was allowed to drift away, till it came into the possession of a fisherman at Boulogne, who made a demand of 60f. for the injury he alleges it did to his nets. Complaints are made by the fishermen, both on the English and French coasts, that the existence of this wire will interfere with their deep sea fishing, and that its track over the Varne and elsewhere is in the way of places most frequented by fish. It is intended, however, at the suggestion of Mr. J. W. Brett, to pay these people an annual rental and to establish for their families a philanthropic fund, to induce them to unite in the protection of this great national enterprise. The assistance of the Admiralty has also been secured for the issue of prohibitory orders against fishing on the route of the electric sea-line, and against ships dropping or dragging anchors over its site. The authorities of Calais and Boulogne have intimated that they will send drummers round the town to advise fishermen not to fish on these spots, and the Company will apply for powers to punish as a misdemeanour any attempts at injuring the wire. The line of wire where it was dislocated is now securely fastened on to the end of a large buoy. Her Majesty's ship *Widgeon*, with Captain Bullock, has traversed the rest of the track, fishing up at intervals the whole of the sunk wire out of 100 feet and 150 feet of water, and laying it down again; thus proving that it has not drifted, and that there were no currents to remove it.

The promoters of the project appear to be fully apprehensive of the inadequacy of the present arrangements, and all their ingenuity is at work to be prepared to meet the emergency. Of currents it may be stated that there is no fear, since it has been ascertained that at certain fixed fathoms, even in the rapids of the Mississippi or at the Menai, there are none below three or four fathoms, and that at five fathoms there is calm water. In order to meet all existing or conjectured difficulty, the character of the undertaking, so far as its magnitude and solidity are concerned, will now be altered. The electric wire, thin as a lady's staylace in itself, will now be incased either in a 5 in. or a 10 in. cable of the diameter of those that placed the Britannia tubes in position, and these will be submerged by the aid of enormous weights. The wire will be imbedded in this gigantic coil or cable, composed of what is called whipped plait with wire rope, all of it chemically prepared, so as to protect it from rot, and kyanised; the whole to be chained down, as it were, as the rails are on a railway, by the gravitation of the huge weights in the bottom of the sea.

WATER POWER OBTAINABLE FROM DRAINAGE.

[From the Report of the Times' Commissioner on the Agriculture of Staffordshire.]

The part of Lord Hatherton's estate at Teddesley, near Penkridge, which is farmed by his lordship, embraces about 1700 acres, a large proportion of which was originally part of Cannock Chase. It extends from the river Penk over the wooded heights which bound the view eastward from the Penkridge station, on the London and North-Western Railway. Thirty years ago the whole of this tract was in a most neglected state, great part of it was a worthless waste, without roads, undrained, and open and exposed to the wintry blasts which sweep

over the elevated grounds of the Midland Counties. It is now a rich and fertile domain, carrying luxuriant crops of wheat and barley, the upper parts ornamented with sheltering woods, the pastures folded over with flocks of Southdown sheep, the extensive farm-buildings filled with cattle, while the lower slopes are covered with verdure produced by irrigation. The skill which has been shown in turning to advantage every provision of nature in each step of progressive improvement is what is chiefly instructive here. The water which soaked through the bogs and elevated swamps, rendering them barren, is drained and collected into a reservoir. From this it is conveyed to the farm buildings, which it supplies with water for the stock; it turns the machinery which manufactures the products of the farm, and then glides off to enrich by irrigation a tract of meadows, 111 acres in extent, the produce of which has been doubled by the process, at an annual cost of 4s. 6d. an acre for attendance in laying on the water.

The ease with which a constant supply of water for driving machinery may be obtained is well illustrated here. A bog, 30 acres in extent, left unplanted in the middle of a plantation, having been considered irreclaimable, was thoroughly drained. Besides the surface water, some strong land springs were tapped, and the whole conveyed by main drains to a reservoir, a few acres in extent, whence the water flows underground about half a mile to the farm buildings. The drainage of this swamp, and that of 140 or 150 acres more adjoining it, gives an ample supply for working machinery of twelve horses power every day throughout the year; and before the lands were drained, this water was not only lost as a motive power, but did immense injury by stagnating beneath the surface, and extending its chilling effects to every portion of ground through which it slowly oozed from its source. At the farm buildings to which the stream is conveyed a mill-wheel, 38 feet in diameter, is sunk into the solid sandstone rock to such a depth that the water discharges itself into it "overshot." The tail water is taken from the bottom of the wheel by a tunnel driven through the solid rock for nearly 500 yards, whence it is conducted into channels for irrigation. When the mill is stopped, the water between the reservoir and the wheel, which would otherwise run to waste, is conveyed by pipes to the different yards and buildings for the use of the stock, from which any surplus finds its way to the meadows. The purposes to which the water power is applied are these:—It turns two pairs of stones (one, as we saw it, grinding wheat, the other pease), it grinds malt, works a circular saw, a lathe, a chaff-cutter, and a thrashing-machine. The whole of these can be worked at the same time, though in practice that is seldom necessary. It has been in operation for several years, working every day, and all day, summer and winter. Independent altogether of the improvement of the land by drainage, and the subsequent use of the water in irrigation, its direct value as a motive power is estimated to exceed 500*l.* a year, and that was obtained by a total expenditure of about 1,700*l.* In a multitude of cases a similar power to this could be as easily got, which at present is suffered to stagnate in the ground, or if collected in drains, then heedlessly allowed to run to waste; for there were no unusual facilities on this estate for obtaining a supply of water. All that is required is procured from the drainage of about 200 acres of land. It is carried in earthen pipes along a gentle declivity, and with very little leakage, about 600 yards from the reservoir to the mill, and is then discharged through a tunnel; the whole distance from the reservoir to the outfall being 1,200 yards, and the total fall being about 50 feet. On this point we take the opinion of Mr. Williams, civil engineer (page 26 of his pamphlet, published by Ridgway), "*On the Application of Drainage Water to Mill Power*:"—

"There is surely nothing here described which would lead a casual observer to imagine that water power equal to twelve horses was to be found in such a situation. The estimate usually formed of the requisites for the use of water as a motive power, is a large stream or brook of water, having a considerable fall in its course, and the term 'millstream' which is given to such currents, invariably conveys the impression of a large body of water, flowing very rapidly down a channel having considerable inclination; the only other idea which seems to be associated with the driving of waterwheels is the nearly vertical descent of a comparatively small body of water down the face of some sharp declivity, and in cases of this kind large overshot wheels are occasionally to be met with; but I am not aware of any other instance where the water derived from the under-drainage of the land, and that alone, has been converted to purposes so valuable, and where so much ingenuity has been displayed in the adaptation of means which, to a superficial observer, would appear totally inadequate to the production of such important results. The merit of the plan consists in its originality; there is nothing in the practical adoption of the principle which suggests difficulty, and every one who examines it on the spot naturally asks himself—why has not this been adopted elsewhere?

GOLD REFINING.

The American papers mention a highly important discovery in gold refining made by Mr. R. S. McCulloh, Professor of Natural Philosophy in Princeton College, and the late U.S. melter and refiner at the Philadelphia Mint. This gentleman professes to have discovered a new, quick, and eco-

nomical method of refining argentiferous and gold bullion, by which the work may be done in one half the time at present required. It appears that the new method would save in labour and materials about one-half of the cost required by the process now used in the mint of the United States, so that the charge to depositors for refining, which is now fixed, according to law, at the actual cost, may be considerably reduced. The apparatus required is less costly and more compact than that used in either of the methods now employed. The advantages in respect to space are such that, it is stated, probably five times as much work as at present may be done in the same building.

MR. PETRIE'S CALCULATIONS OF THE COMPARATIVE VALUE OF HEAT AND ELECTRICITY AS MOTIVE AGENTS. (SEE ANTE, P. 188.)

The following remarks on Petrie's calculations of the comparative value of heat and electricity as motive agents are given by Mr. Samuel Hockling in the *Athenæum*.—Mr. Petrie states, "that the best Cornish engines only yield one-fourteenth of the power that the combustion of the carbon actually represents. Now, if we consider the heating value of the coals to be represented by the quantity of carbon which they contain, it will be found that one pound of coal of a good quality and such as will raise in the best Cornish engine 1,000,000 lbs., 1 foot high, will have heating power equal to above 10,000°,—which, being multiplied by Mr. Joule's equivalent of 700, as used by the author, we shall have for the theoretical power of 1 lb. of coal the sum of 7,000,000, and the practical result in the Cornish engine being the sum of 1,000,000, or one-seventh "of the power that the combustion actually represents." The author has not therefore given a correct statement of the practical value obtained from heat. It is, in fact, just double the value which he has given it. The comparative cost of power obtained from heat and electricity, according to the author's statement of the quantity of zinc required per horse-power per hour, theoretically and practically :—Theoretically, the consumption of zinc in the battery should be 1·56 pound per hour per horse-power. Practically, it is from 50 to 60 pounds per hour. Assuming that the price of zinc is 20*l*. per ton, and the price of coal 10*s*. per ton, their relative price will be as 40 to 1. *Two pounds of coal* per hour will, used in the best Cornish engine, produce the power of one horse; and to produce the same amount of power by the best electro-magnetic engine *fifty pounds of zinc* must be consumed. Their comparative cost will therefore be as $\left(\frac{40 \times 50}{2} = 1,000\right)$ 1,000 to 1. Even supposing with the author, that engines may be constructed to give one-fourth of the theoretical power, the cost compared to the cost of coal will be as $\left(\frac{6·24 \times 40}{2} = 124·8\right)$ 125 (nearly) to 1."

EDWARDS'S ATMOPYRE.

According to Dr. Arnott, England, of all countries, is the most extravagant in the use of fuel. The comparative cheapness of coal in Britain is the cause of this carelessness. The inconveniences, however, occurring in large towns, especially where manufactories are numerous, from the diffusion, in the shape of smoke, of the unconsumed particles of the fuel, and the consequent deterioration of health, have prompted the invention of many methods for the prevention and destruction of smoke. One of the most novel of these inventions is suggested by Mr. D. O. Edwards; it is named the "Atmopyre" or solid gas fire. A small cylinder of pipe-clay, varying in length from 2 to 4 inches, perforated with holes the fiftieth of an inch in diameter, in imitation of Davy's Safety Lamp, is employed. The cylinder has a circular hole at one end, which fits upon a "fish-tail" burner; gas is introduced into the interior of the cylinder, with the air of which it becomes mixed, forming a kind of artificial fire-damp. This mixture is ignited on the outside of the vessel, and burns entirely on the exterior of the earthenware, which is enveloped in a coat of pale blue flame. The clay cylinder which Mr. Edwards calls a "hood," soon becomes red hot, and presents the appearance of a solid red flame. All the heat of combustion is thus accumulated on the clay, and is thence radiated. One of these cylinders is heated to dull redness in a minute or two; but an aggregate of these "hoods" placed in a circle or cluster, and enclosed in an argillaceous case, are heated to an orange-colour, and the case itself becomes bright red. By surrounding this "solid gas fire" with a series of cases, one within another, Mr. Edwards has obtained a great intensity of heat, and succeeded in melting gold, silver, copper, and even iron. Mr. Palmer, the engineer of the Western Gas-light Company, by burning 2 feet of gas in an atmopyre of twelve "hoods," raised the temperature of a room measuring 8,551 cubic feet, 5° of Fahrenheit in seventeen minutes. The heat generated by burning gas in this way is 100 per cent. greater than that en-

gendered by the ordinary gas flame when tested by the evaporation of water. 25 feet of gas burnt in an atmopyre per hour, produce steam sufficient for a 1-horse power. Hence the applicability of the invention to baths, brewing, &c. The inventor's attention has been chiefly directed to the warming of invalids' apartments; and for this purpose he employs the following apparatus:—A battery of twelve "hoods" is enclosed in an earthenware case, which, becoming heated to 500° Fahrenheit, forms a repository of heat. This is placed in an outer case of china, terra cotta, or any other ornamental ware. The products of combustion are carried away by a small pipe into the chimney. It would be better to let this pipe remain in *alto-relievo* in the apartment. The fresh air is brought from outside the dwelling through a tube about 6 in. in diameter, which communicates, by means of a valvular iron plate, with the space between the two cases. The air ascends in this area in large quantities, is warmed in its transient contact with the inner case, enters the room through large holes in the top of the stone, at a blood-temperature, and spreads equally through the apartment. This fire presents a cheerful aspect through the wide orifice of the stone, which is covered with glass, and is visible to every inmate. The expense of such a fire is sixpence a day, at the present price of gas: and its application to cooking, evaporating liquids, desiccating aromatic plants, &c., is decidedly economical. Hydrogen burnt in the "atmopyre" produces great heat, and a very bright fire.—*Lancet.*

PATENT LAW CASE.

Liverpool Summer Assizes, Aug. 21, 1850.
Before Mr. Justice Cresswell.

WALLINGTON *v.* DALE,

*Surviving Partner of Nelson, Deceased.**

This was an action for the infringement of a patent dated Nov. 24, 1847, granted to G. P. Swinborne, for his invention entitled "Certain improvements in the manufacture of gelatinous substances, *and in the apparatus to be used therein.*" The patent had been assigned to the Plaintiff, and it was alleged that the Defendant, as a member of the late firm of Nelson and Company, had subsequently infringed the patent.

It appeared that the deed of assignment bore date 12th February, 1848, more than three months before the enrolment of the specification; and also that the patentee, on the 24th May, 1848, enrolled a specification, and also entered a disclaimer of the words—"and in the apparatus to be used therein," contained in the title.

The specification described an invention which came within the meaning of the undisclaimed words of the title, but did not describe any apparatus, and therefore if the disclaimer was not sufficient, the second branch of the invention had not been specified.

The Defendant had pleaded all the usual pleas for denying the alleged infringement and the validity of the patent, and also a plea (the 6th) alleging that at the time of the entry of the disclaimer, the patentee had no interest in the patent, and that therefore he had not entered the disclaimer according to the form of the statute.

Mr. Martin, Q. C. (with whom were Mr. Webster and Mr. Fletcher), having stated the case to the jury, gave in evidence the patent, the assignment, the specification, and the disclaimer, bearing the dates which have already been stated.

Mr. Watson, Q. C. (Mr. Crompton and Mr. Hindmarch with him), for the Defendant, then contended that the patentee, having assigned over the whole of his right to the patent before the time of entering the disclaimer, had no power to make the entry under the 5 and 6 Will. iv., c. 83, s. 1, the statute which authorized the entry of disclaimers, and therefore the verdict upon the issue raised by the 6th plea must be for the Defendant. That, although in Spilsbury *v.* Clough (2 Q. B., 466), it was held that a patentee having only a part of the patent right vested in him might enter a disclaimer, that case had been in effect overruled by the Exchequer, in Russell *v.* Ledsam (14 M. & W., 574). That the evident meaning of the statute was, that a disclaimer should be entered by a person having title to the patent, and not a person who has become a stranger to it. That this construction of the statute was confirmed by the subsequent Act of 7 and 8 Vict. c. 69, s. 5, and that to hold the present disclaimer to be good would be to enable a patentee, after assigning his patent, to deprive the holder of it of any part of the invention he might think fit.

Mr. Martin, for the Plaintiff, contended that the disclaimer had been duly entered, and that the Defendant could not raise a point of law of this description at Nisi Prius. That the case of Spilsbury *v.* Clough was an authority in favour of the Plaintiff

* We were unable to procure a sufficiently accurate report of this case at the time it occurred, and we now publish it because of its great importance to parties about to enter disclaimers.

and that the case of Russell *v.* Ledsam did not directly apply. That the patentee, Swinborne, was a person who had obtained the patent, and therefore had power under the statute to enter the disclaimer notwithstanding the assignment, and that the advertisement required by the Attorney-General was a sufficient protection to assignees.

Mr. Justice Cresswell said that the issue on the plea certainly raised a point of law, but that it was not the Defendant's fault that it had come there to be determined. That the facts alleged by the plea having been proved, the question of law to be decided was whether the patentee had entered the disclaimer *in pursuance of the statute*, which he could not do if he were not the person authorised to enter it. That the first statute (5 and 6 Wm. IV. c. 83, s. 1), in his Lordship's opinion must be constructed as authorizing the entry of a disclaimer by a party having title to the patent, and that the subsequent statute (7 and 8 Vict., c. 69), which recites (in sec. 4), that doubts had arisen touching the power given by the previous statute in cases where patentees have wholly or in part assigned their right and (in sec. 5), expressly authorised the entry of disclaimers by assignees, thus confirmed the construction which his Lordship put upon the first statute.

His Lordship therefore directed the verdict upon the sixth plea to be entered for the Defendant, and as this would (if not overruled by a superior court) prevent the Plaintiff from recovering, the Jury were by consent discharged from finding any verdict upon the other pleas.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING SEPTEMBER 19TH, 1850.

James Nasmyth, of Lille, France, engineer. *For improvements in the method of obtaining and applying heat.* Patent dated March 12, 1850.

These improvements consist—

1. In a mode of, or apparatus for, heating air for the purpose of warming buildings, apartments, conservatories, &c., which is applicable also to the drying of goods, and other like processes wherein heated air is employed; and

2. In various modifications of the preceding apparatus, by which it is made applicable to the revivification of animal charcoal, to the manufacture of animal and vegetable charcoal, to the manufacture of gas, coke, &c., to the generation of steam, to the roasting of coffee, to baking bread and cooking, and to various other roasting and torrefying purposes.

The patentee's heating apparatus consists of a number of metallic chambers, or, more properly, channels, surrounded by a furnace, and arranged in such manner as that the products of combustion and heat shall play around them. These chambers are open at bottom to admit a current or currents of air, and at top communicate with pipes, through which the heated air is conveyed and applied as required.

The modification of the apparatus employed for the revivification of animal charcoal consists of a metallic chamber, fitted to the interior of a furnace, so as to allow room between it and the furnace sides for the flame, &c., to play around. This chamber communicates, by means of a narrow passage closed by a slide, with an air-tight box placed underneath, in which the charcoal, after having been subjected to the action of the furnace, is received and allowed to cool before removal. The matter to be operated on is supplied from above, through a box with a moveable bottom, which forms a cover for the receiving chamber.

By slight modifications, varying with the nature of the operations to be performed, the same apparatus is rendered available for any of the purposes before mentioned.

Claims.—1. The passing of air through shallow metallic chambers placed vertically or horizontally in a furnace, both ends of which chambers are outside the furnace, the air passing in at one end and out at the other.

2. The construction and arrangement of various modifications of the apparatus described applicable to the purposes before set forth.

George Jenkins, of Nassau-street, Soho, Middlesex, gentleman. *For certain improvements in the means of producing motive power.* Patent dated March 18, 1850.

The object of this patent is the production of a reciprocating motion, for the purpose of driving machinery, by the combined application of hydraulic and pneumatic pressure.

Water is received into a cistern which communicates, by a long tube bent upwards at its end, with a cylinder open at top. A second pipe is so placed as to form a continuation of the first; near the point of junction are two stopcocks connected to each other by a bar and parallel levers, so that, on turning the cocks, one passage will be opened and the other shut. The lower end of the second tube is inserted in a vessel filled with water, and acts as a water valve. On turning the cocks, the water flows from the cistern down the first pipe, and rises into the cylinder, forcing upwards a working

piston. When the cylinder is full, and the piston at the top of its stroke, the cocks are again turned, and communication with the cistern is cut off. The water now flows from the cylinder down the second pipe into the vessel before mentioned. The pressure of the atmosphere acts in opposition to the vacuum caused by the escape of the water from the cylinder, and forces the piston down. On turning back the cocks, this operation is repeated. The reciprocating motion thus obtained is to be applied through the piston-rod. The stop-cocks are worked by a cam fixed to the shaft of the fly-wheel.

The first pipe should be of a length equal to the height to which a column of water will rise in vacuo by atmospheric pressure, and the lower pipe should be longer than the upper one. No claims are given.

RECENT AMERICAN PATENTS.

(Selected and abridged from the *Franklin Journal*.)

IMPROVED WINGED METALLIC CARTRIDGES. *A. D. Perry.*

This invention consists, firstly, in slitting the nearest end of the hollow part of the ball a given distance apart around the periphery, and in lines parallel or slightly oblique to the axis, so that after the charge of powder, with a gun cotton or other equivalent cap over it, has been inserted, the slitted parts can be bent in, overlapping each other to secure the charge, and which, after the ball is discharged from the barrel of a gun or other fire-arm, will be spread out by the force of the discharge and form spiral wings, to give a rotary motion to the ball to guide it in a straight line; and, secondly, in forming the forward end of the ball with a nipple to which is fitted a percussion cap, so that when the ball strikes and enters a magazine, &c., the explosion of the cap may ignite the body struck, when this is used in combination with a ball having wings or other means of guiding and keeping the cap in front.

IMPROVED MODE OF MANUFACTURING GLUCOSE. *George Riley.*

Glucose, or grape, sugar is made by this patentee from the meal of Indian corn, by boiling the same under a pressure greater than that of the atmosphere in water acidulated with sulphuric acid.

IMPROVED MODE OF ROLLING INDIAN RUBBER CLOTH. *Hayward and Bickford.*

The patentees say "our invention or process consists in taking a piece of cloth, or any other sheet material (to whose surface it may be desirable to apply and fix Indian rubber), and a quantity of ground Indian rubber (when in a tacky or adhesive state, in which it is after being ground or reduced by the usual process of grinding crude caoutchouc) and running or passing the same together (the caoutchouc being on one side of the cloth) between two cylinders or rollers (placed with their axes parallel, and their curved surfaces in contact, or nearly so), and in such manner that while the upper of the said rollers, or that in contact with the caoutchouc, is made to revolve at a greater speed than the lower one, it (the said upper roller, or that in contact with the caoutchouc) shall spread and grind, it as it were, into the cloth below, and fix it to that surface of it which is immediately contiguous to said roller, viz., that roller which revolves at the greatest speed.

COATING IRON WITH COPPER OR ITS ALLOYS. *E. G. Pomeroy.*

This process of coating iron consists in cleansing with sulphuric acid, defending the cleansed surface with a coating of clay or other alluminous earth, drying the same, and then plunging the article thus coated into melted copper or some alloy of that metal. The patentee claims particularly the use of the clay paste to protect the metal from oxidating, during the process of alloying or coating.

SUBMERGED ROCKER FOR SEPARATING ORES. *O. Edes.*

Into a frame there is fitted any required number of pans, which can be removed and replaced at the pleasure of the operator; the frame is provided with pivots or journals, which have bearings in the ends of levers or arms attached to a box-boat or platform, in such a manner that the frame carrying the pans can be lowered into or raised from the water; the earth to be washed is placed in the pans and lowered below the surface of the water, and the frame carrying the pans is then rocked by means of a lever operated by a person in a box or boat, or upon a platform, to which the frame may be attached.

IMPROVED ORE WASHER. *W. M. Hughes.*

The metallic ores are to be washed by means of oblique currents of water, and a horizontal one passing over the same in a reverse direction; the oblique currents being produced by inclined surfaces or their equivalents.

Mesmerism as a Mechanical Power.—Some most interesting experiments by Dr. Elliotson, in which patients, by a reinforcement of mesmeric power, were shown capable of swinging round large weights *impossible to be even lifted by them in their ordinary condition*, prove an intimate connection between the mesmeric medium and the muscular force, which, as every one knows, is dependent on the state of the nerves, and by them conducted from the brain. And so also with natural sleep-walkers, "they will stand self-balanced on the ridge of a house, where, under the usual conditions of consciousness, they could not preserve their equilibrium for a single moment."—*Rev. C. H. Townshend's Facts in Mesmerism.*

A Model Steam-Engine Chimney.—An American writer (H. F. Fairbairn) pronounces the chimney of the West Middlesex Water-Works Company, at Turnham Green, to be the finest ever erected in England. (Mr. Tierney Clark, we believe, is the architect.) "It is," he says, "more beautiful as a column than the Monument of London—the pillar built by Sir Christopher Wren in commemoration of the Great Fire in the Reign of Charles II. It is crowned by a Corinthian cap, in fine proportion with every other part of this noble specimen of a steam-engine chimney, which is only deficient in the inferior colour of the bricks of which it is built, and in its position, which is neither on elevated ground nor in a part of the country where its beauties can be very fully displayed. The proportions of this chimney are considered to be complete." Length of shaft, eight times the diameter of the base; diameter of the top, one-half that of the base.

United States' Navy.—The number of steam vessels, of all classes, belonging to the United States' Navy, is only seven; but they have four new ones on the stocks, to be called the *Powhattan*, *Susquehannah*, *Savanae*, and *San Juento*. The first two are 250 feet long, and 45 beam; the last two, 196 feet long, and 37 beam. The first two have side wheels, and two inclined engines, each with cylinders 70 inches diameter and 10 feet stroke; the third has side wheels and two inclined engines with 60-inch cylinders, 9 feet stroke; and the fourth has a screw propeller and two inclined engines working across the ship, with cylinders 60 inches in diameter, 4 feet 2 inches stroke.

Essence of Milk.—Mr. Moore, an extensive farmer in Staffordshire, has, under a license from the patentee of the new process of concentrating milk, fitted up an apparatus by which he manufactures annually the produce of about thirty cows. The milk, as it is brought from the dairy, is placed on a long shallow copper pan, heated beneath by steam to a temperature of about 110°. A proportion of sugar is mixed with the milk, which is kept in constant motion by persons who walk slowly round the pan, stirring its contents with a flat piece of wood. This is continued for about four hours, during which the milk is reduced to a fourth of its original bulk, the other three-fourths having been carried off by evaporation. In this state of consistency it is put into small tin cases, the covers of which are then soldered on, and the cases and their contents are placed in a frame which is lowered into boiling water. In this they remain a certain time, and after being taken out and duly labelled, the process is complete. The milk thus prepared keeps for a lengthened period. It supplies fresh milk every morning on board ship, and may be sent all over the world in this portable form.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of Fleet street, London, patent agents, for improvements in purifying water, and preparing it for engineering, manufacturing and domestic purposes. (A communication.) Sept. 19; six months.

Henri Jeremy Christen, of Paris, engraver, for improvements in cylinder printing. September 19; six months.

Jasper Wheeler Rogers, of Dublin, civil engineer, for certain improvements in the preparation of peat, and in the manufacture of the same into fuel and charcoal. September 19; six months.

William Eccles, of Walton-le-Dale, Lancaster, cotton spinner, for certain improvements in looms for weaving. September 19; six months.

Samuel Brisbane, of Manchester, pattern maker, for certain improvements in looms for weaving. September 19; six months.

James Nasmyth, of Patricroft, Lancaster, engineer, and John Barton, of Manchester, in the same county, copper roller manufacturer, for certain improvements in machinery or apparatus for printing calicoes and other surfaces; and also improvements in the manufacture of copper, or other metallic rollers to be employed therein, and in the machinery or apparatus connected with such manufacture. September 19; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Sept. 12	2435	Thomas Honnor	Leadenhall-street	The "Utilis" over coat.
"	2436	Henry Phillips	Birmingham	Shield for broach pins.
13	2437	Enoch O. Tindall and Lorenzo Tindall	Scarborough	Cooking range.
16	2438	H. J. and D. Nicoll,	Regent-street.	Wrapper cloak.
"	2439	C. R. Mead	Old Kent-road	Gas meter.
17	2440	Edward Bing	Ramsgate	Window and door weather joint.
"	2441	Thomas Boyle	Wolverhampton	Trousers strap.
18	2442	Joseph Welch and John Margetson.	Cheapside	"Cantal" braces.

CONTENTS OF THIS NUMBER.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1416.] SATURDAY, SEPTEMBER 28, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

STEVENSON'S PATENT FLAX-SPINNING MACHINERY.

Fig. 1.

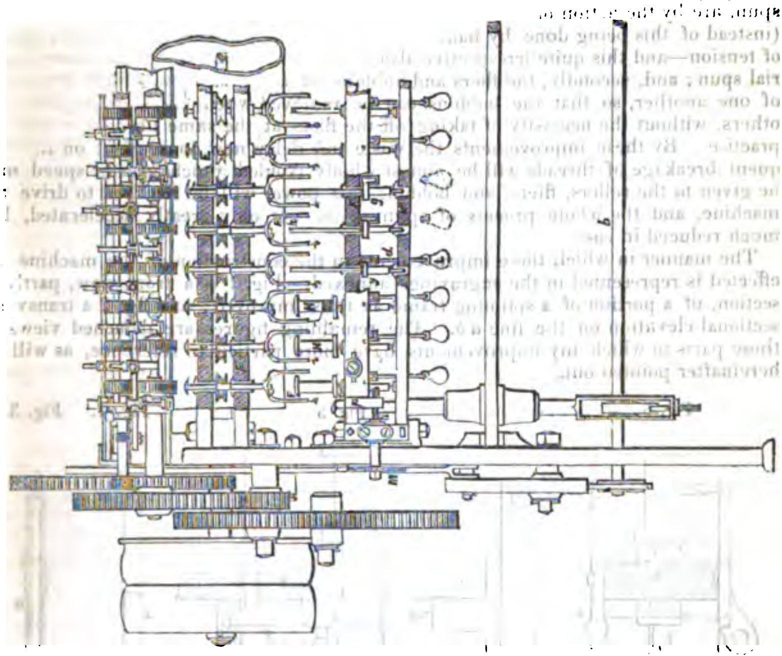
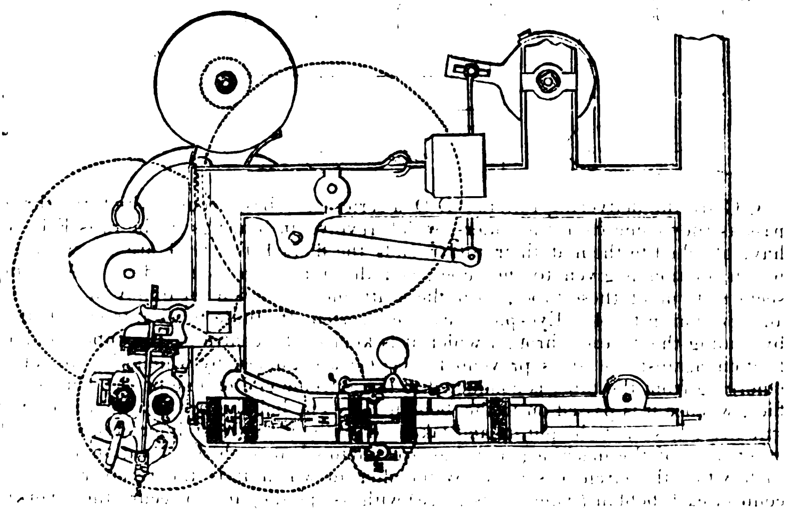


Fig. 2.



STEVENSON'S PATENT FLAX-SPINNING MACHINERY.

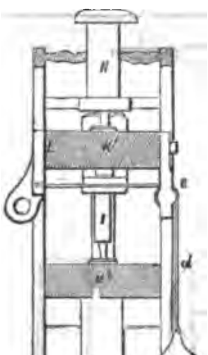
(Patent dated March 23, 1850. Specification enrolled September 23, 1850. John Stevenson, of Roan Mills, Dungannon, County Tyrone, Flax-spinner, Patentee.)

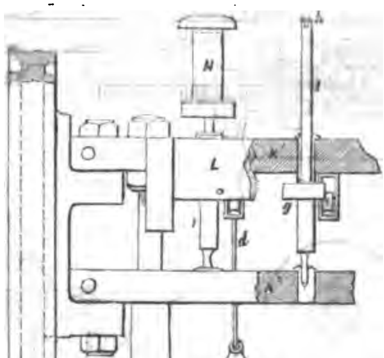
Specification.

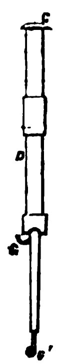
The nature of my invention consists in an improved construction of the ordinary spinning frame, whereby, firstly, the threads, while in the course of being spun, are by the action of the machine itself kept at the requisite degree of tension (instead of this being done by hand, as at present), and all at one uniform degree of tension—and this quite irrespective also of the coarseness or fineness of the material spun; and, secondly, the fliers and bobbins (or cops) are mounted independently of one another, so that the bobbins can be removed when filled and replaced by others, without the necessity of taking off the fliers at the same time, as is now the practice. By these improvements the waste and delay now consequent on the frequent breakage of threads will be almost wholly avoided, much greater speed may be given to the rollers, fliers, and bobbins, less power will be required to drive the machine, and the whole process of spinning be not only greatly accelerated, but much reduced in cost.

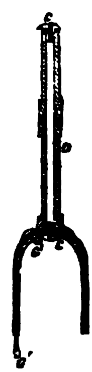
The manner in which these improvements in the construction of the machine are effected is represented in the engravings annexed. Fig. 1 is a front view, partly in section, of a portion of a spinning frame as thus improved; and fig. 2 a transverse sectional elevation on the line *a b*. The remaining figures are detached views of those parts to which my improvements have more particular reference, as will be hereinafter pointed out.

Fig. 6. Fig. 5. Fig. 4. Fig. 3.









C C are the delivering rollers; D D a series of tubes through which the threads pass as they come from the rollers, which revolve in bearings in the rails E E, and have attached to them at their under ends the fliers F F. G G are the wheels by which rotation is given to the tubes, and through them to the fliers. A vertical section of one of these tubes, with fliers attached, is given separately in fig. 3, and an elevation in fig. 4. Eye-pieces *c c* are inserted into these tubes at top and bottom, by leading the threads through which it is kept in the centre of the tubes, and any friction against the sides prevented. G^1 G^1 are guides, by which the thread, on emerging from the tube, is conducted to the extreme end of one of the arms of the flier, whence it is passed on to the bobbin H. The bobbins are mounted loosely on spindles I I, so as to be put on and taken off without the least interference with the other parts of the machine; and they are mounted at such an elevation as to come each within the circle described by the flier to which it is the receiver. But, to connect each bobbin (when in its place) with its spindle, and to secure their working

together, a wire is passed crosswise through the axis of each bobbin, which takes into a cleft *h* in the top of the spindle. The spindles have their bearings in the rising and falling rails K^1 K^2, which constitute what is technically called the "builder." To the front rail K^1 there is attached a sliding plate L, which acts on the spindles and bobbins in the manner to be next explained. For every spindle and bobbin there is a weight attached to the sliding plate by means of a cord *d*, which bears against a pulley *g*, and then passes over the side pulley *e* to the weight. At each rise of the plates K^1 K^2, or builder, they raise along with them the paul P, which turns the ratchet wheel M, which gives a partial turn to the screw N, which works into a nut *p* on the face of the sliding plate L, and thereby draws the plate L from the right towards the left, which causes the cord *d* to press against the periphery of the pulley *g* in a ratio increasing successively with each rise of the builder.

A front elevation and end view of a portion of the machine, showing the arrangements connected with the bobbins, and spindle, and sliding plate, on an enlarged scale, are given in figs. 5 and 6. The weights L are so adjusted by trial that when the ends of the threads are passed once or twice (by hand) round the bobbins, the weights shall not prevent the threads from causing, by their own action alone, the bobbins and their spindles to revolve, but shall be just sufficient at the same time, with the assistance of that sliding plate, to keep the threads at the one uniform degree of tension requisite for the production of good work without interruption from breakage and piecing.

MEMOIR ON THE VARIOUS METHODS ADOPTED AND PROPOSED FOR THE PRESERVATION OF TIMBER. BY M. S. B.

(Continued from page 223.)

The frequent instance of rapid decay, by which so many vessels of war were destroyed at the early part of this century, occasioned a variety of minutes to be submitted to the Navy Board by Sir Samuel Bentham, after he became a member of it; particularly his letter of 6th March, 1812, proposing a timber-seasoning house. This was prefaced by a view of the difference which had then been experienced in the durability of timber of different instances, and the precautions and preparatory processes that had been employed for rendering it more durable; the most material parts of that preface, but under a different arrangement, appeared in the second article of the *Quarterly Review* for the following October, which was said at the time to have been drawn up by Mr. Croker, Secretary of the Admiralty, who, of course, was acquainted with Sir Samuel's letter.

Although the principal facts and observations it contains have already appeared in No. 1282 of the *Mech. Mag.*, yet the importance of them as a connected history of what was then known on the subject—indeed, of all that has since been positively ascertained—a repetition of them, in his own words, may be acceptable to its readers. The letter was as follows:—

"In regard to the durability of timber in some cases, Westminster Hall and Abbey, and a number of cathedrals, churches, and old mansions, afford examples where timber, used in the construction of *buildings on land* has remained in a perfect state for many centuries; and even in regard to the timber used in the construction of *ships*, the *Royal William* is a noted example of the possibility of timber, applied to that use, lasting near a century. On the other hand, timber, of late years, has been found often to decay so rapidly, particularly where a species of decay, denominated the dry rot, has taken place; that in the instance of buildings on land, the wood-work has fallen to pieces in the course of a twelvemonth, and in ships the same rapid decay has been found to take place within a year or two after their construction has been completed.

"In such instances as those above alluded to, where the duration of timber for centuries has been unquestionable, it does not appear, either from any examination of the timber in its present state, or from any knowledge we have of the practice of those remote times, that the timber was submitted to any preparation, other than that of its having been cut down a length of time before it was used, sufficient for the natural

moisture to have been in a great degree dried away. Indeed this kind of seasoning seems to have been looked upon as requisite in all countries, and at all times, the practices of which are on record. In regard to timber cut into boards, and pieces of such small scantling, it has been usual to pile them one on the other in the open air, in such manner as to let the air pass in some degree between them; by which means, although the ends and exterior pieces have been more or less rent and injured by the sun and wind, and by the frequent wetting by rain, the more protected pieces and parts have become what has been called seasoned, in the course of from one to ten or more years, according to the thickness of the pieces, and the uses to which it was intended to put them. In regard to large timber, it has frequently been left to season gradually in the open air, with the sap remaining in: in this way it has been found, in the course of some years, according to its size, to have become seasoned; that is, although the exterior sap has rotted away, interior parts of the log have become compact, hard, and dry, with little or no cracking of the timber itself. In cases, on the contrary, where the sap, together with some of the outside of the perfectly formed timber itself, has been cut off, that is, in the state called sided, the outside of such pieces as have not been protected from the weather, has been more or less cracked, before the inside has been sufficiently seasoned.

"To obviate the mischievous effects of the weather during the time of seasoning, buildings of different constructions have been provided in the Royal dock-yards; in which, wood of all kinds has been deposited in various ways, more or less suited to the passage of air between the several pieces; the general result of which has been, that in regard to deals and timber cut into small scantlings, whereby the evaporation of the juices from the interior has been much facilitated, the keeping such deals and scantlings under cover appears to have been advantageous. In regard, however, to sided timber, thick-stuff, and even plank for ships' use, in cases where the buildings have been closed so as to prevent the air about the timber from being changed, the timber so enclosed has been found to decay very soon; and where a free passage of air has been admitted at all times, the exterior, and particularly the ends of the timbers, have been found more injured than when left in the open air; so that, as well in the Royal dock-yards, where seasoning-sheds of different constructions have been used, as in other countries, where I have seen timber kept under cover for the construction of ships, the injury done, in some cases by the too great ventilation, in others by the want of sufficient ventilation, has been greater than the benefit obtained by this mode of seasoning timber: besides which, a farther loss has been incurred of the cost of the buildings, and the expense of labour in taking the timber in and out.

"As to the timber used in the construction of buildings on land, it is often employed where it can dry gradually after it has been applied to use; as for beams or rafters left uncovered, in these cases previous seasoning may not be essential to durability; but in regard to timber used for the construction of ships, the case is very different; the most important part of the timbers, particularly the frames, are so enclosed, that, unless they be previously well seasoned, these parts may well be expected, as in fact they have been found, to decay very rapidly; and even in regard to those parts of ships, to the surface of which the air has free admission, the junctures are in most cases liable to become wet by rain or leakage, without there being any passage for air to dry them again: and as the exterior surfaces are many of them coated with some pigment, which prevents the evaporation of the moisture from the inside, so those parts, unless the timber be sufficiently seasoned, before the ship is completed, are found to decay very rapidly, notwithstanding their general exposure to the air. It seems, therefore, essential to the durability of a ship, that the whole of the wood that enters into its construction, should be perfectly seasoned previously to its being put to use.

"As to the best mode hitherto in use for the seasoning of timber for ship-work, it appears from all the observations I have been enabled to make myself, and to collect from others, that no other mode has been so effectual as that of allowing the timber to lie in the open air, with the sap in, whereby the outside of the heart (or perfectly formed wood), has been protected from the immediate action of the sun and air; and the drying away of the juices from the whole, has proceeded so gradually and uniformly, as not to cause any cracking or separation of the fibres: but as the length of time necessary for seasoning in this mode, is greater than the supply of timber to his Majesty's dock-yards has provided for, and greater than any private ship-builder can be expected to provide for, the short duration of some ships of war of late years, compared to some that had been built heretofore, may well have arisen, in general, from the timber not having been duly seasoned before it had been put to use. And as to the difference to be observed in the duration of

ships, none of which can be supposed to have been built with timber sufficiently seasoned, this I think may be well accounted for, by the difference in the state of the weather at the time of closing in the frames, by a difference in the leakage of ships, and by the more or less frequent use of the means in practice for ventilation; to which also must be added the effect of dry rot, which, though it seems to originate in moist wood, has been found to spread its destructive effects by contact only, even to wood that is dry and seasoned.

"Some expedients for the more hasty seasoning of timber have been tried. In warm countries, the covering timber with sand, has been found to admit the heat of the sun to penetrate to the timber, so as to dry the moisture so gradually away, as to prevent the cracking of the exterior. In Deptford-yard, timber has been covered with unslacked lime, which, by the heat produced while slacking, rendered the timber very dry, compact, and hard, in a short time; but the application of so great a degree of heat so suddenly as it was applied, from the manner in which the experiment was conducted, caused the timber to be so *cracked* and *rent*, as to prevent the farther continuation of the experiment; nor does it seem likely that this mode of applying artificial heat should be eligible, on account of the difficulty of regulating it, independently of its cost.

"Timber has also been partially *charred*, as a means of preservation; as for instance, the ends of beams have been frequently charred, and the timbers and other parts of the *Royal William* are said to have been so generally. The practice of charring those parts of buildings on land which are contiguous to the ground, and the lower parts of posts to be sunk into the ground, has shown the efficacy of this expedient; but the *sudden* application of heat for this purpose to the surface of timber, according to the usual mode of charring, if continued long enough to *dry* the *interior* parts, has been found, while it destroys the texture of the outer part, to *crack* and *rend* the timber *within* so much, as to be objectionable on that account.

"Artificial heat has, however, very advantageously been made use of by private individuals, manufacturers, and others, for the drying of boards and pieces of small scantling; and from all the opportunities I have had of examining the state of timber so prepared, the due seasoning without cracking has appeared to depend on the ventilation happening to be *constant*, but very *slow*, joined to such a due regulation of the heat, as that the *interior* of the timber should dry and keep pace in its contraction with the outer circles.

"In Russia, the practice of suspending boards and wood, cut into small scantlings, in workshops which are always much heated in winter, and very little ventilated, has appeared to be more generally advantageous than elsewhere.

"The only instance in which I have seen a building and apparatus constructed purposely for the seasoning timber by artificial heat, and in which the requisite attention was paid to the admission of enough, and not too much air during the operation, was at the great cotton manufactory of Messrs. Strutt, at Belper, near Derby, where planks and deals were well seasoned without injury; the planks in the course of three weeks, and deals in a proportionably shorter time.

"That under some circumstances, a heat even greater than that of boiling water can be applied to wood, without cracking or otherwise injuring it, may be seen in the instance of the steaming of plank and thickstuff in a close kiln. It is therefore on the providing the means of applying any degree of heat, even greater than that of boiling water, to the whole of the timber to be used in the construction of ships, on the varying this heat suitably to the different kinds of timber to be seasoned, and to the different states and stages of its seasoning, on the regulating at pleasure the admission of dry air, and the emission of that charged with vapor, that my expectations are grounded, in respect to the advantages to be derived from the use of the seasoning houses in question.

"In regard to the impregnating wood with *chemical preparations*, for the purpose of rendering it more durable, this seems well worth attention as the object of a series of well-grounded comparative experiments; although the experience already had on this subject is not sufficient to justify the use of any of those preparations, otherwise than as a matter of *experiment*. Several chemical writers, and others, have suggested long ago the impregnation of wood with solutions of metallic salts; as the sulphate of copper, recommended by Dr. Hales, and the sulphate of alumine by many, in support of the advantages of which, the long duration of the wood used in allum-works has been adduced, which wood becomes, on use, impregnated with allum. So, timber bedded in sulphate of lime, as it often is in Derbyshire, is said to be particularly durable. I have known the impregnation of wood with sulphate of iron used, as a preservative against, and cure for the dry rot, as in the instance of the negro-house, mentioned in my minute of the 13th September last; and

which impregnation I have understood to have been very efficacious in that and some other instances. But the means of impregnating wood either expeditiously or effectually with such solutions are both difficult and costly, excepting by previous exhaustion of the air from the wood, as first specified, with a view to the impregnation of timber, in a patent of mine obtained sixteen or seventeen years ago. In America, I have understood that impregnation with *oil* has been used with good effect for the preservation of wood against decay, as well as against the destructive action of the sea-worm; and some experiments I made at Plymouth Dockyard many years ago, gave reason to expect that this mode would be advantageous. I have also seen, in a variety of cases, great advantage as to seasoning and duration from impregnating wood with the vegetable and carbonic acid gases arising in the smoke of burning wood. In Russia, many small articles, such as the parts of wheels, wheel carriages, and sledges, are prepared and seasoned in this manner; so are wheels, at least in some parts of America; and sabots, and other small articles in France. Having been satisfied, therefore, of the good effects as to durability of seasoning wood by the exposing it to the action of acids arising from the burning of wood, I caused, in 1805, one of the small arches over the reservoir in this dockyard (Portsmouth) to be used as a drying and seasoning-house in the way of experiment; and as block-shells appeared from their size, from the nature of the wood employed, and from their exposure in use to require some artificial preparation, I took them as the subjects of a series of experiments on this mode of seasoning; but the progress in these experiments was put a stop to by my mission to Russia.

"These experiments were, however, so far prosecuted as to show that, by exposing the block-shells to the smoke of burning wood, they become, in the course of two or three days, well seasoned in every respect—hard, bright-coloured, and, as it were, polished. Several block-shells, prepared in this manner, were made up into finished blocks, and brought into use; but it was found, that in a very short time the acid with which the shells were thus impregnated very rapidly corroded the iron pins which passed through them; so that the disadvantage on this account was deemed more than equivalent to the advantage of seasoning the shells, and the practice was therefore discontinued. Seasoning block-shells in steam was also begun to be tried, but was not prosecuted to any considerable length."

On reference to the facts stated in the preceding extract, it is evident, from the very different modes in which timber has been seasoned and prepared, that they have been adopted without reference to any principle derived from scientific inquiry, or to the *rationale* on which the preservation of wood by any of those various modes has been grounded; hence a wide field is open to scientific investigation on the subject, and which, if accompanied by a series of well-grounded experiments, could not fail of proving eminently useful in all the multitude of cases in which wood is employed.

It appears from Sir Samuel's letter of 1812 that timber has been prepared—

By simple desiccation, in the open air, buried in sand, &c.

By artificial desiccation, in appropriate buildings; by heated air, as at Messrs. Strutt's, at Belper; and by immersion in unslaked lime; to which may be added the lately patented desiccation of Messrs. Symington and Co.

By steam, as in the plank kilns in royal dockyards, and by the late Mr. Prosser, of Birmingham, as now appears. (See below.)

By charring the exterior surface, as customary for posts, &c., driven into the ground—for the inside of water-casks.

By washing out the natural juices of the wood, called water-seasoning.

By impregnating it with oils—with pyroligneous acid—with various chemical preparations, as sulphates of copper and iron, muriate of mercury, &c.

And since that time, Paine's process has been invented, which, as "T. P. J." states, consists in the soaking timber successively in two different solutions—the one acting chemically on the other, so as to form crystals between the fibres of the wood.

That Mr. Prosser had seasoned timber by steam for a large building at Birmingham, was not known to Sir Samuel; but from information lately obtained, it appears that when a contract was taken by Mr. Prosser, although the wood was not any of it provided, yet, by means of steam, the whole was seasoned, worked up, and in its place in the course of a few months;—that the wood was wrough with remarkable care, and that it has stood well, without in any way warping or shrinking. The wood in this case was put into a close iron receptacle, of

large size, which was kept filled with steam.

In a series of experiments such as Sir Samuel had in view, the first object would be to ascertain, whether it be by mechanical or by chemical agency that the rapid decay of timber is prevented. Even by simple desiccation at the ordinary temperature of the atmosphere, it is possible that, by the mere approximation of the fibres, extraneous moisture may be excluded, and thus internal decay may be prevented. In this case, the preservation of the wood would be in consequence of a mechanical effect;—so also Paine's process is evidently supposed to act mechanically by filling up the pores of the timber. Impregnation with oils may also act, in the same way, mechanically; and so it may be possible that the intromission of all salts and acids may be useful only as filling up the pores of wood.

It seems probable that this mechanical action may have some beneficial effect; but there appears reason to suppose that the long duration of wood depends on a chemical change in the juices contained in growing timber, or in washing them out. Experience seems to prove that winter-felled timber is less subject to decay than summer-felled; in the former case, the natural juices are, for the greater part, converted into woody fibre; in spring or summer-cut timber, on the contrary, those juices are in their unassimilated state. It is not known whether, by simply drying those juices, they lose the capability of being re-dissolved, so as to be still susceptible of fermentation. To ascertain this point would be the subject of one set of experiments. Some of the fermentable juices are known to be decomposed by a heat of even less than 150° of Fahrenheit. Is it by the *heat* of steam,—of that produced by covering wood with sand in hot climates—by the conversion of lime into chalk—or by occasional great sun-heat, to which timber spread abroad may be exposed,—as likewise is it by the heat in charring wood, that these deleterious juices are rendered innoxious? A set of experiments would be required to solve these questions.

The efficacy of water seasoning depends on the washing away of those juices, supposed to be the cause of the decay of timber; but experiment has not yet ascertained decidedly that they are so. Here, then, is ground for other experiments to determine positively the matter of fact.

How far such oils as whale-oil may act as preservatives of timber otherwise than as against sea-worms, does not seem to have been ascertained; but, as above mentioned, woods containing oil naturally, being remarkably durable, it seems well worth experiment to ascertain whether they might not be artificially impregnated with oils, other than that of tar, for use in naval architecture particularly.

Impregnation with pyroligneous acid, with oil of tar, with sulphates, muriates, and other chemical preparations, all depend, in every case, without doubt, on their chemical action on the easily destructible parts of timber interposed between its woody fibres. Creosote, for example, combines with potash, soda, ammonia, &c.; it dissolves several salts, particularly the acetates; it coagulates albumen, and prevents the putrefaction of both animal and vegetable substances. The chief aim of experiments on these several preservatives would therefore be their comparative cost; in this respect, no other would probably be found to compete with oil of tar; but where the smell of it renders it objectionable, it is highly desirable that the actual expense of other preservatives should be ascertained. In Sir Samuel's minute of the 13th Sept., 1811, he recommended the trial in the way of experiment, amongst other chemicals, of "diluted sulphuric acid, uncombined with any base." Mineral acids, diluted, but in an uncombined state, do not appear yet to have been applied to the preservation of wood; but if the beneficial agency of salts depends on their chemical properties, there seems good reason to suppose that it is the acid which produces the good effect; and should this, on experiment, prove true, sulphuric acid might be found even a cheaper preservative than oil of tar. It does not, however, seem that any other matter than oils would protect wood from the sea-worm.

Certain as seems the efficacy of charring wood, the way in which it operates is not known. Charcoal is far more absorbent of water than wood; charring a surface cannot therefore keep the interior of wood dry; and though charcoal itself is

in a manner incorruptible, though it absorbs putrid vapours from contiguous bodies, yet it does not prevent their formation in them; it does not seem likely, therefore, that the shell of charcoal should protect the interior of a piece of timber. How, then, does charring act? In this operation considerable heat is produced—perhaps sufficient to destroy the perishable parts of the interior of the wood. Both pyroligneous acid and oil of tar are generated in the operation, and these may one or both of them be driven into or absorbed by the unburnt part of the wood. Here is another subject of experiment.

In undertaking a course of experiments on this, as on every other subject, each experiment should be confined to one single point of inquiry, not permitting a combination of any two subjects. To give an example of doubt as to the cause of efficacy, it may, in Paine's process, be either mechanical or chemical; mechanical, if the good effects of it depend on the formation of crystals; chemical, if on the action of the fluids introduced, since both of them are capable of acting chemically on the unassimilated juices of the wood. In this instance, truth might be elicited by impregnating one piece of timber with one of the fluids, another piece with the other of them, a third piece with both fluids, so as to combine in crystals; then exposing the three pieces so prepared to the same sources of destruction until one or more of the pieces should decay.

A series of exhaustive experiments on the preservation of wood can hardly be within the scope of private enterprise, on account principally of the great length of time that must elapse before results in the more successful cases can be obtained—a century, perhaps, as in the instance of the *Royal William*, and of several centuries, as in the instances of buildings on land adduced by Sir Samuel. Unfortunately for experiments made on Government account, it is not, in any department of it, the duty of any person or persons holding office consecutively to see to or register experiments, so that the result of most important ones is often lost. It was so in regard to an experiment instituted with great care early in last century as to the comparative durability of summer and winter-felled timber. Sir Samuel caused the books of office for forty or fifty years to be examined respecting it. From them it appeared that a vessel was built with great care, for the purpose of this trial—that strict orders were given at the time to observe and report upon it; but subsequently to the building of the vessel, not a record could be found of the result of that experiment; nor has any subsequent trials set this question at rest, for even in the evidence given to the Committee in the House of Commons, 1848, it appeared that officers high in the civil service of the Navy had nothing better than vague opinion to guide them on the subject. In private undertakings, "T. P. J.'s" statement of an instance of failure of Paine's process, exhibits the liability of private works to circumstances defeating the success of an experiment. But supposing experiments relative to the preservation of wood to be made, whether on a large or on a small scale, a determination of the *rationale* of the subject should be the main object —not whether this or that patented process be a little better or a little cheaper than such another. So far as is at present known, it would be desirable to ascertain, whether long duration of wood depends on the bringing its woody fibres into close contact, or otherwise excluding moisture between them—whether by depurating them from prejudicial matters, by washing them out—or whether by chemically decomposing those matters, and thereby rendering them innocuous.

It should be kept in mind that the preservation of wood from decay, the rendering it obnoxious to sea-worms and other insects, the preventing the growth of fungi, and the rendering it little susceptible of injury by fire, are distinct objects of inquiry, and in many cases requiring different means for producing the desired effect. Thus oils which, probably, as a class prevent the ravages of sea-worms, render wood, as "T. P. J." has said, highly inflammable; on the contrary, as Sir Samuel has shown, wood impregnated with the sulphates of alumine and lime, is thereby rendered durable, and at the same time, as far as experiments have gone, less subject to conflagration; whilst sulphates, having iron or copper for their base, prevent the growth of the fungus which occasions dry rot.

In the *Illustrated News* of the 31st

August last, a description is given of the American line ship *Cornelius Grinnell*, in which it is said that the wood is seasoned with salt. This would seem rather a promoter of decay than a preservative, since salt—that is if the common salt obtained from the waters of the ocean be meant—attracts moisture from the atmosphere; and water pent up between the fibres of wood is known to hasten its decay.

In the summer of 1805, when Sir Samuel was making experiments on seasoning wood at Portsmouth, he applied to Mr. Wm. Strutt, of Derby, for his opinion as to the length of time that would be required to dry in his mode, oak of eight or ten inches thick. Mr. Strutt replied, that he had no experience in the desiccation of wood of that thickness,—that he considered 70° of Fahrenheit was as great a degree of dry heat as timber could safely be exposed to. "But," he adds, "is the principle right?" The principle of *dry* heat, that is; and he continued—"Your question has led me into reflections on this subject, the details of which, however, I have neither leisure to write nor you to consider at present; but the result is a strong conviction that the application of *steam* would be the most effectual, the most expeditious, the most economical, and the least prejudicial method of drying wood artificially that can be devised. I do not mean strictly steam, but vapour at the heat of perhaps 200°; for steam being perfectly dry, would certainly destroy the wood." On reference to this Magazine, No. 1282, page 229, it will be seen that Sir Samuel provided for the desiccation of wood by steam in the seasoning-house he devised, should experience prove the eligibility of that mode:—"Parts of the floes are formed of cast iron, in the form of shallow pans, which would serve for the generation of steam," &c. That seasoning-house was, indeed, calculated for making experiments on a large scale, whenever previous smaller ones should indicate the expediency of extending them." What the degree of heat of the steam was in Mr. Prosser's apparatus, is not known; but from a short description of it, there seems reason to suppose that the heat of the steam in it might have been somewhat less than that of boiling water. At all events, experiments to verify the soundness of Mr. Strutt's idea and Mr. Prosser's experience, would doubtless lead to most important improvements in the art of seasoning timber.

MR. STEPHENSON'S "ORIGINAL IDEA."

Sir,—Your correspondent of last week, Mr. Prosser, C.E., while contending for the *sole* claims of Mr. Stephenson to the invention of the tubular bridge, says—"The original idea is what is generally called the 'invention,' for which letters patent may be obtained: how much of the invention of tubular bridges remains after deducting the original idea of Mr. Stephenson?" And your correspondent also asks—"At what stage, if any, of an invention, can the aid of scientific and practical men be called in, without the risk of their claiming to be sole or joint inventors, and thereby depriving the first inventor of perhaps the only honour he cares about?"

I reply, that an invention is not a notion, an abstract conception, or an idea—but it is an actual construction, composed of tangible materials, and assuming a definite shape. The knowledge of all the parts of an invention, and their relations to each other; or, in other words, the knowledge of how to make the machine or construction, may exist abstractedly in the mind; but if it does so, the party possessing it is able, and, I presume is bound by the Patent Laws, to give instructions by specification, so that ordinary workmen can make the invention forthwith, and certainly without the assistance of experiments; for if experimentalizing be necessary, *the conclusions derived therefrom, form part, if not the whole*, of the knowledge necessary to constitute the invention; and therefore it is easy to see that at no stage of an invention can the assistance of a scientific and practical man be called in without the "risk" of his claiming a share of the invention,—for the obvious reason, that, through his instrumentality the invention is completed; and the fact of the necessity of having recourse to his assistance establishes the conviction, that without such assistance the invention would not have existed at all. A perfected invention necessarily embraces the details of successful construction;

but an "original idea" may stop short at some general property which characterizes failing concerns as well as successful ones; for instance, an "original idea" may conceive of a bridge as tubular, and stop there, and a practical inventor may proceed to develope that idea in half a dozen different constructions, all ending in failures, which may lead him to abandon the idea as worthless; or perhaps he perseveres till the knowledge obtained by further experiments enables him to accomplish a work which before was a mere fancy, and, so far as experience had tried it, a proved impossibility. So different is an invention from the mere mental conception of some of the properties of it, that I suppose hereafter there may be many patents taken out for tubular bridges (the patentees having only to take care they do not claim Mr. Fairbairn's details of construction), in the same way as every week produces some new sort of steam engine, the inventor of which is not supposed to interfere with the ideas of the party who first conceived of steam as a motive power. Perhaps most of the inventions that future ages will develope, have already had their existence in the shape of an original idea. Flying machines, and a variety of aërial locomotives, &c., have already lived some time in such forms. Need I mention the Marquis of Worcester's century of inventions—how many of his conceptions have been realized? Mr. Stephenson's idea might have been like those of the Marquis, who conceived that such things might be done, but at the time was probably as incapable of doing them as any person having no such ideas at all. Suppose Mr. Stephenson, like Rip Van Winkle, after conceiving his "original idea" of a tubular bridge, had gone to sleep, and not have awaked till now, would he not hasten down to the Straits to learn, for the first time, how his original idea had become an invention—a practicable thing? Mr. Stephenson's idea is totally independent of Mr. Fairbairn's experiments and their consequent result; the honour due to the one gentleman remains the same, while the honour due to the other depends on the success of his experiments. If Mr. Fairbairn's experiments had proved a tubular bridge to be an impracticable thing, his fame on that score would have been—nothing; while Mr. Stephenson's, as a bold thinker and original suggester, would remain the same; and it may be, that where two parties are concerned, the honour due is not so much to the original suggester as to him who renders the thing practically successful—for it is very easy simply to suggest, and a multitude of magnificent, and perhaps original ideas, may be formed in a very short time, because there are no bounds to the imagination, which is the only instrument we require to work with in this sort of construction; but to make the thing practically successful is altogether another kind of work, requiring a knowledge which the first suggester may not, and is often found not to possess—so that there appears decidedly to be a separate merit and honour due to the individual through whose knowledge the thing becomes a useful invention; especially when there appears no evidence to show that without his knowledge the thing could have been made to answer. Your correspondent, in the following paragraph, gives a singularly inapposite quotation from St. Paul:—"Mr. Stephenson said as much as any prudent man could say in giving his evidence *about an untried thing* before the Railway Committee, 1845; and at the conclusion of his evidence he might, no doubt, truly have said, in the words of St. Paul, 'I have fed you with milk, and not with meat; for hitherto ye were not able to bear it, neither yet now are ye able.'" This use made of St. Paul's words implies that Mr. Stephenson, at the time of giving his evidence, had the whole of the invention so perfected in his own mind, that had he fully revealed his thoughts on the subject, he would have astonished and confounded the Committee, and he therefore withheld the shock, for "they were not able to bear it;" but the former part of the paragraph shows, on the contrary, that at that time Mr. Stephenson himself was only in the "milk state."

No doubt certain parties have overlooked some words of St. Paul which really *have* a bearing on this question—"*In honour preferring one another.*"

I am, Sir, yours, &c.,

C. E.

Sept. 18, 1850.

CARTE'S PATENT FLUTES.

(See *ante*, p. 219.)

Up to the present time, certain notes of the flute have been produced by means of keys, acted upon by the thumb and little finger of the left hand; and those notes were produced by one or other of the following means:—On some flutes (for instance, the old eight-keyed flute), the keys of which are closed over their respective holes by means of the ordinary springs, the required holes are opened by pressing down the arms of the respective keys by the thumb and little finger. By this arrangement, the holes under each key remain closed when the pressure is taken off, in consequence of which, the notes produced by uncovering the holes next above these keys are rendered imperfect. On other flutes, again (for instance, the Boehm flute), these keys are kept open by their springs, and are respectively closed by the pressure of the thumb and little finger. As this is the only action by which these keys can be closed, the consequent confinement of the thumb and little finger cramps the action of the other fingers, and the execution or rapidity of fingering is impeded. Now both these defects are obviated in the flutes of Mr. Carte, by the employment of a mechanism which acts upon the keys referred to by the action of the other fingers, so that, when certain notes are given, by pressing down one or other of these fingers upon its respective hole or key, the same action may close the key upon which the thumb or little finger has hitherto solely acted, thus leaving the thumb or little finger, as the case may be, at liberty; and, by this means, a very great rapidity of execution is obtained.

The same mechanism for releasing the thumb may be applied in the construction of bassoons and hautboys, and the mechanism releasing the little finger of the left hand can also be similarly employed in the construction of clarionets and hautboys.

Mr. Carte has, moreover, introduced quite a new fingering for the note designated on the concert flute, D natural. The note hitherto produced upon this flute, in the second and third octaves, when all the fingers are raised, is C sharp; whereas by the new mode, when all the fingers are raised, the note produced is D natural, an extra hole being expressly pierced for this note at the proper nodal point. As the note D natural is in almost perpetual use, the object of this part of the invention is to give increased facility of execution when the note D natural is used in combination with other notes. The tone of the C sharp is also improved, while the fingering is not rendered more difficult. The C sharp is fingered by pressing down the first finger of the right hand, with or without the second and third fingers. This part of the invention is also applicable to the production of the corresponding notes upon the hautboy.

A third improvement by Mr. Carte consists in imparting a finer quality of tone to the C natural on the second and third octaves. The usual mode of producing this note is by pressing down the second finger of the left hand, and the first, second, and third fingers of the right hand. Hitherto, by this mode of fingering, the C sharp hole only has been opened above the second finger, and the C natural hole closed; or the C sharp hole has been closed, and only the C natural hole opened above the second finger; which, in either case, produces a bad note, owing to the B natural hole, which is the hole next below the C natural, being shut. To obviate these objections, the same mode of fingering is adhered to, but the C natural hole and the B natural hole are both open (each note on this instrument having a distinct hole at the proper place). The C natural hole is not closed; and by employing two holes for the B natural, when one is closed by pressing down the second finger of the left hand, the other is left open, which gives the C natural its full force. In ordinary flutes, the first, second, and third fingers of the right hand close their respective holes in sounding the C natural; while, by this improvement, these fingers may be pressed down or not, as convenient. The B natural is fingered in the same way as on the ordinary concert flute; namely, by pressing down the first finger of the left hand.

A fourth improvement consists in the application of means by which the performer may be enabled to pass rapidly and distinctly from the note D natural to F natural, and from E flat to F natural:

In those flutes in which the F sharp is produced by putting down the first, second, and third fingers of the left hand, and the first finger of the right hand, on their respective holes, the F natural is produced by pressing the second finger of the right hand on its proper hole, and the third finger of the right hand upon a key to open the F natural hole. The same note, F natural, is also produced by a well-known duplicate long key, closed by its own spring, and *opened* by a pressure from the little finger of the left hand. By this invention the fingering of the F natural is simplified when used in the combination alluded to, by having a duplicate F natural hole, which remains open, while the other (the ordinary F natural hole) remains shut. The hole of F sharp is closed by a key operated upon by the little finger of the left hand, all above being closed as before mentioned; so that when the first, second, and third fingers of the left hand are pressed upon their respective holes, the little finger of the left hand shutting the F sharp hole by a key, and the first finger of the right hand being pressed down, the note F natural will be produced, leaving the second and third fingers of the right hand disengaged.

By these several improvements in the flute the tone of the instrument is rendered more perfect, the notes are all of equal quality, and the execution is greatly facilitated — each note and semi-note having a perfect and even shake and turn in the high as well as the low notes.

C.

GENERAL METHOD OF SOLVING CUBIC EQUATIONS.

Sir,—Having observed the insertion in your Magazine of several papers, by Mr. Cockle, treating upon the Analysis and Solution of Cubic Equations, I thought that you would perhaps not object to insert in your widely-circulated and invaluable Magazine the following general method of solving complete cubic equations, which, I have no hesitation in saying, will be found to be more simple in its arrangement, and also easier in its practical operation, whilst at the same time it may be more easily retained in the memory, than any general method hitherto given. I have submitted the rule to several eminent mathematicians, who have spoken of it with decided approbation.

I will now give you the rule, without any further remarks:—

Let there be given the cubic equation

$$x^3+ax^2+bx+c=0,$$

to find x. Rule:

Put $a_1=\frac{1}{3}a$ and $b_1=\frac{1}{3}b$;

and take

$$A=b_1-a_1^2,$$

$$B=\tfrac{1}{2}(a_1b_1-c),$$

$$C=B+a_1A,$$

$$D=\sqrt{C^2+A^3},$$

$$E=\sqrt[3]{C+D},$$

$$F=\sqrt[3]{C-D}, \text{ or } =-\frac{A}{E};$$

then will $x=E+F-a_1$.

The two expressions which I have put down for F will be found to be always equivalent; it will frequently be found to be more convenient to use the latter, as it dispenses with an extraction of the cube root.

I will just give one example, as an application of the above neat rule. Let

$$x^3-6x^2+18x-22=0$$

be given to find x. Here

$$a_1=-2,\ b_1=6, \text{ and } c=-22;$$

whence, by the rule

$$A=b_1-a_1^2=2,\ B=\tfrac{1}{2}(a_1b_1-c)=5,\ C=B+a_1A=1,\ D=\sqrt{C^2+A^3}=3,$$

$$E=\sqrt[3]{C+D}=\sqrt[3]{4},\ F=\sqrt[3]{C-D}=-\sqrt[3]{2},$$

whence

$$x=E+F-a_1=\sqrt[3]{4}-\sqrt[3]{2}+2.$$

I would just observe, that when $C=0$, a cubic may be solved by this rule, even though the *three roots may be all real*; in which case the rule gives as one of the

roots $x = -a_1$. I may also observe, that when $C^2 + A^3$ is positive, *one* root is real —when negative, *three*.

I am, Sir, yours, &c.,
SAMUEL BILLS.

Hawton, near Newark-upon-Trent,
Sept. 20, 1850.

THE ELECTRIC CLOCK.

Reader!—Have you ever seen an electric clock? If not, you ought to wish to see one of the wonders of this wonder-working age—a beautiful example of natural phenomena co-operating with the skill of the mechanician. Perhaps you have seen the clock; and after pondering over its curious arrangements, and carefully examining its extraordinary movements, you may wish to preserve a little remembrancer of it—just enough to refresh the memory when an opportunity offers for talking about it to others.

Here is a description of it—the best I can supply, without the aid of drawings. The clock we have had before us is enclosed in a neat oak case, about 4½ feet in height, and 1 foot 4 inches wide. Its face is of ample dimensions, very plain in appearance, and furnished with second, minute, and hour hands, in all respects similar to those of the usual construction. The pendulum is the same length as that of an ordinary old-fashioned eight-day clock. Here, however, analogy ceases. It it true, there are some wheels and pinions to move the hands, and give the usual indications of the divisions and progress of time. These are few in number, and do their work in a manner totally different from the wheels in other kinds of clocks. The electric clock has neither weight nor spring, nor power of any other kind, within itself, to keep it in motion; and it, therefore, never requires winding up. The terms employed to denote important parts of common clocks are inapplicable to this. Thus, the escapement of a clock implies some contrivance by which the motive-power is permitted to escape; that is, to expend its force in such equal quantities, and at such exactly equal intervals that the motion of the hands shall be uniform so long as the power is maintained. As the going, or maintaining, power of the electric clock is entirely independent of the machinery, there is no necessity for an escapement.

Whence, then, does this clock derive its power of continuous motion? Wait a little —I will try to explain it.

There are two very fine copper wires fixed in the angles of the clock-case, which communicates with similar wires at the back of the pendulum-bar, and are thence continued to a coil (helix) of the same kind of wire, surrounding an armature of soft iron, and the whole of which is enclosed in a circular brass box. This box constitutes what is usually termed the bob of the pendulum; but whilst it answers that purpose it performs another, and most important, duty as an electro-magnet. The box is hollow, in the direction of its axis, and the cavity thus formed admits of the insertion of two sets of permanent magnets, whose similar poles are placed near to, but not in contact with, each other. These magnets are kept in their places by being enclosed in brass boxes secured to the sides of the clock-case. The pendulum is so adjusted that it has perfect freedom of motion; in its oscillations passing and repassing the poles of the magnets just mentioned.

Leaving the clock for a few minutes, we observe two copper wires, the ends of which are in contact with those within the case. Continuing their course along the wall, these wires pass out of doors, descend below the surface of the earth, and, at a short distance from the house, are connected, one with a few bushels of coke, and the other with five or six plates of zinc. These materials are buried in a hole in the earth, say about 4 feet square, and 5 feet deep. The coke is placed at the bottom, with a layer of earth above it, and the zinc plates are laid thereon; the whole being covered up and forming a galvanic battery. Herein consists the power which imparts motion to the clock. A current of electricity is induced by the coke and zinc, which, although of very low intensity, is unlimited as to the quantity. The pendulum being set in motion, and the current of electricity through the wires established, a beautiful arrangement of simple mechanism immediately comes into operation, by means of which the circuit is broken and renewed at each alternate oscillation. This is effected by a thin bar of steel, the points of which, shaped like lancets, work upon agate bearings. The current of electricity is transmitted through the bar, which is set in motion by the pendulum, every time one of the points passes over the conducting wire. The combined agencies of galvano-electricity, electro-magnetism, and permanent magnetism, are thus made to produce an uniform, and, so to speak, perpetual motion of the pendulum; and we obtain a time-measurer of such extraordinary accuracy that I believe it will bear comparison, in this respect, with the best, constructed chronometers. Let it be observed, that the electric clock has nothing within itself for putting, or keeping, the hands in motion. The power comes from outside the house, is communicated to the pendulum, and by the pendulum to the

wheels. These are small in size and few in number, and have nothing to do but to turn upon their bearings. There is no pulling, or pushing, or straining of any kind, and therefore the least possible amount of wear. The clock here referred to has been going since March, 1847. Its rate is uniform, and its fidelity as a time-measurer is one of its most remarkable properties. The battery has never been touched or looked at since it was made. Its power is in no way affected by atmospherical changes, whether of heat or cold, moisture or dryness.

If it be desired to have other clocks in different parts of the house, that which I am describing requires only to be connected with them by a copper wire, and the circuit completed to the battery, when they will all be kept going by the motion of one pendulum, and all record exactly the same time.

Such is the electric clock, invented by Mr. Alexander Bain, of Edinburgh,—a gentleman deservedly known in the scientific world for his successful labours in connection with the electric telegraph.

J. O. N. R.

Black-rock, 1850.

PROVISIONAL REGISTRATION.

The necessary arrangements for carrying the Act for this purpose into effect are in progress, but have not been yet quite completed. By the first clause of the Act, "the manner and form" of the registration is to be "prescribed or approved by the Board of Trade;" and that Board has the matter still before it. We observe, from the tenor of several inquiries which have been addressed to us on the subject, that an impression prevails extensively that designs and inventions of all sorts may be thus provisionally protected. This is a great mistake; for the Act is expressly confined to such *designs* only as "may be registered under the Designs Act of 1842, or the Designs Act of 1843." Persons desirous of obtaining the protection of this Act, with a view to the Exhibition of 1851, will do well to note also, that the protection will be lost should the place where "any design provisionally registered" is exhibited be one to which the public are admitted gratuitously. The place of exhibition must be one to which "the public are *not* admitted gratuitously." Now, on this head, the Commissioners of the forthcoming Exhibition have not as yet committed themselves to any positive determination; they talk of admitting the children of the national and charity schools for nothing; but if they do so (as perhaps they ought), they will render the Provisional Registration Act altogether a nullity.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING SEPTEMBER 26TH, 1850.

William Joseph Horsfall, and Thomas James, both of the Mersey Steel and Iron Works, Toxteth-park, Liverpool, Lancaster. *For improvements in the rolling of iron and other metals.* Patent dated 19th March, 1850.

The principal object proposed to be effected by these patentees, is the rolling of iron to form conical tyres for bevelled or chamfered wheels, a process which, performed as at present, by hammering, is both tedious and expensive.

The iron proposed to be operated on, having been reduced in a roughing mill as nearly as possible to a convenient size, is passed while hot between rollers set at an angle, by which it is formed into a bar with edges of unequal thickness. This bar is next submitted to a pair of parallel rollers, whereby its sectional diameter is reduced, and then to a third rolling operation, which turns it out, of a curved flat shape or curved flat strip. In this state the iron may be used as a rim for paddle or water-power wheels.

While still hot, the bar so formed is ready for bending into the tyre form, which is performed by a machine of the following construction:—A circular plate or table is fixed on an upright shaft supported by an arm, and stepped in a fixed stud. To this shaft is keyed a bevel wheel, which works into another actuated from a prime mover, whereby a rotary motion of the table is obtained. The table has radial slots cut in its surface to receive adjustable stop-pieces, which serve to retain firmly a ring of the same size and form as the wheel to which the tyre is intended to be attached. One end of the heated bar is introduced, and secured by wedges between this ring and a lug, and a rotative motion being imparted to the table, the bar is drawn round the ring, and the tyre completed with the exception of welding the ends. A roller attached to a hand lever, guided by a groove in the framework, is pressed against the bar, and serves to maintain close contact between it and the ring. The patentees observe that sheets of zinc formed by the above rolling process may be economically employed in the formation of conical vessels, the metal being cut in strips radiating from the centre of the circle of which these curved sheets are segments, and then soldered.

Claim.—The rolling of iron and other metals (which it may be desirable to submit to the improved rolling operations) into bars or strips and sheets, by first passing the metal under operation between rolling surfaces set at an angle to each other, and after-

wards submitting it to rolling surfaces parallel to each other, whereby the advantages before described may be obtained.

THOMAS EDMONDSON, of Salford, printer. *For improvements in the manufacture of railway and other tickets, and in machinery or apparatus for marking railway and other tickets.* Patent dated March 19, 1850.

The improvements in the "manufacture of railway tickets" consists in employing, instead of the card-board of which they are ordinarily formed, strips of some suitable woven material, which is pasted with paper on each side, or calendered, to produce a surface sufficiently smooth for printing.

The improvements in "machinery or apparatus for marking railway and other tickets," have relation to the well-known numbering machine formerly patented by Mr. Edmondson, and consist—

1. In an arrangement for regulating the accumulation of tickets.

2. In an improved method of marking and numbering the tickets, whereby more distinct impressions from the types employed are obtained; and

3. In stamping of the inscription, so as to dispense wholly or in part with the use of ink.

JOHN VARLEY and JOSEPH HACKING, of Bury, Lancashire, engineers. *For certain improvements in steam-engines and apparatus connected therewith.* Patent dated March 23, 1850.

Claims.—1. A peculiar construction of equilibrium valves through which the working steam passes to the cylinder. Also the employment of rings, the cross sections of which are square or rectangular in the construction thereof, as exemplified and described.

2. The introduction of plates or slides between the cylinder nozzles, or steam passages, and the valve facing, for the purpose of cutting off the steam at any required period of the stroke, as described.

3. The placing of expansion plates under the cut-off valves, and thus forming moveable thoroughfares or passages by which the expansion is regulated.

4. The connecting of a high-pressure cylinder, or cylinders, working a distinct crank-shaft, to a low-pressure cylinder, and working the two as a compound cylinder ngine, as described.

5. Certain peculiar arrangements of a compound cylinder engine, whether one or two high pressure cylinders be employed.

6. The particular arrangement of three forms of engines, which are described.

7. Placing the steam passages of horizontal engines at the lowest part of the cylinder.

8. A peculiar arrangement of valves, as applied to locomotive engines.

9. An arrangement for working and reversing the valve of each cylinder of locomotive engines, irrespective of the cut-off slide, with one eccentric.

10. The employment of a portion of the steam, after its passage through the engine, to heat the water used for filling the boiler of a locomotive engine.

11. A steam boiler registering apparatus, as described.

12. A mode of connecting the doors of steam-engine furnaces with a damper or valve placed in the flues.

13. The attaching of vessels or receivers to steam-engine boilers, for the purpose of collecting the sediment therefrom.

14. The application of cone drums or other variable gear to furnace hoppers, for regulating the supply of fuel, controlable by expansion gear.

15. A peculiar construction of air-pump pistons through which the fluids of condensation descend in their passage from the pump.

16. The combination of different-sized spur pinions sliding into gear with two other spur wheels whereby the position of a cam or eccentric, can be altered while the engine is in motion.

17. A peculiar combination of spur gearing, wherein two or more spur wheels move over the peripheries of two other or more spur wheels for altering the position of eccentric cams, studs, or other cut-off gear.

18. The application of a spring weighted lever, or other yielding re-acting medium to a friction cone, or other variable gear whereby a variable altering motion is communicated to the expansion gear.

[We shall give full details, with engravings, of two or three of this numerous list of inventions in a future Number.]

ALFRED GUILLAUME ROSELEUR, of Paris, but now of 4, South-street, Finsbury, Middlesex, chemist. *For certain improvements in coating or covering metals with tin.* Patent dated March 23, 1850.

The first part of these improvements is applicable to tinning small articles, such as tacks, hooks-and-eyes, &c., on which a deposit of tin is precipitated by dipping them in a bath composed of water 22 lbs., ammoniacal alum 17½ ozs., and protochloride of tin or other soluble salt of the same base 1 oz., heated to about the boiling point. The alum employed will last for a considerable time, and when the bath is weakened by precipitation of the tin therein contained, the addition of a small quantity of the above salts, or other salts of tin, will restore its action. Cast iron, and other metals in the rough, on immersion in this bath, will be scoured and cleansed, and thereby prepared for either of the following processes.

The second improvement consists of a

new mode of coating with tin the surfaces of cast iron and other metals and alloys. The metals to be operated on are to be first cleaned or scoured with azotic, hydrochloric, or other suitable acid to remove the oxide, and then immersed in a bath composed by digesting in 17½ pints of soft water, 10½ ozs. of bitartrate of potash or soda (tartaric acid, or acidulated tartrite of potash, or soda cream of tartar), and then adding an aqueous solution of three-quarters of an ounce of protochloride, or other soluble salt of tin. The metal to be coated is immersed in this solution, and the tin precipitated by the addition of zinc in small pieces. By this method a covering is formed of equal thickness in every part, so that, unlike the operation by immersion in molten tin, in this case the original roughness or inequalities of the metal operated on are not affected. And this circumstance is stated to give additional value to the process, and to render it applicable to a variety of purposes in the arts for which the old process is unsuited.

The patentee describes, lastly, a process of electro-plating with tin. This process of electro-plating has hitherto been applied mainly to depositing the precious metals, and in cases where tin has been experimented on, the chemical substances used, such as cyanide of potassium, &c., were so expensive as to render the process of little commercial value. The bath in which the metal to be coated is immersed consists of 17½ ozs. of water, deprived of its alkaline salts, 11 lbs. of pyrophosphate of potash or soda, and 4 lbs. 7 ozs. protochloride of melted tin. The positive pole is an anode of tin, not in contact with the metal to be coated. This process is applicable to iron or steel, copper, lead, &c.

Claims.—The coating of metals or alloys of metals by the direct superposition of tin in a suitable stannic solution, and the application of the said process to the scouring of metals, or alloys of metals, intended to receive a future coating.

2. The application of the process of double affinity for the purpose of tinning metals and alloys of metals by means of the simultaneous presence of any metal and zinc, or any other metal analogous thereto, in a solution purposely prepared, as before described.

3. The applications of the voltaic current to the decomposition of a suitable solution of tin for the purpose of coating metals and alloys of metal, as before described.

Horatio Carter, of Thirza-place, Old Kent-road, Surrey, gentleman. *For certain improvements in the production of light from ordinary coal gas by the use of burners consisting of more than one ring or sheet of flame combined with a suitable chimney or chimneys, and supplied with atmospheric air, particularly adapted to ventilation.* Patent dated March 23, 1850.

The first improvement described by Mr. Carter has reference to concentric gas-burners, which have hitherto deen generally constructed without due regard (so he affirms) for the admission of that quantity of air only between the rings of flame which is requisite to ensure perfect combustion of the gas; and this is assumed to be attained by constructing burners with jet-holes one thirty-second of an inch diameter, and one-eleventh of an inch apart; the space between the rings being one-quarter of an inch, equivalent to a difference of half an inch between the internal diameter of the outer ring and the external diameter of the inner ring. A plug is inserted in, and partly fills the orifice in the centre of the inner ring, and the space for the admission of air between the flames is consequently fifteen times greater than the aggregate of the jets. These proportions are calculated for the employment of ordinary coal gas, and may be varied when gas of other quality is used. Mr. Carter also describes various modifications for three concentric rings of jet.

2. Following this, we have a description of a gas chandelier. The gas is supplied from above by three pipes, which support a concentric burner of three rings. These pipes serve also as a support for glass pendents, which are suspended close to each other. Immediately above the burner is placed a conical deflector, on the top of which fits a chimney of ground glass. A ring of talc, corresponding in size to the second burners, is fitted into the bottom of the chimney to contract the flame, and an earthenware or other pipe through which the products of combustion are carried off forms a continuation of the chimney. The end of the pipe exposed to the air is furnished with a cowl, to prevent currents of air from entering. By encasing this pipe with a second, which also communicates with the exterior of the building, the air between them is rarefied, and causes draught sufficient to carry off the vitiated air, and thus acts as a ventilator.

Claims.—1. The construction of concentric gas-burners, as described, whereby the supply of air to the burners is regulated so that an approximation to the quantity requisite for the entire combustion of the gas is admitted to the flame, and also the application of a conical deflector and chimney in the manner and for the purpose before mentioned.

2. Illuminating by means of a cut glass chandelier enveloping and surrounding jets of flame, as described. And

3. Ventilating apartments by means of gas-burners, as described.

WILLIAM SYKES, of York-street, Westminster, tallow-chandler. *For improvements in the manufacture of candles and wicks.* Patent dated March 23, 1850.

The improvements described and claimed by Mr. Sykes consist—

1. In several peculiar modes of manufacturing dipped candles partly of tallow and partly of stearic acid.

2. In coating externally dipped candles with a compound of bismuth and borax.

3. In impregnating the wicks of dipped candles, plaited or plain, before dipping, with a solution of borax or bismuth, or a compound of bismuth and borax. And

4. An improved apparatus for suspending and cutting wicks.

Of the apparatus which forms the subject of the fourth claim, and which is a great improvement on those in common use, we shall give a full description in a future Number.

ALFRED WILSON, of Myddleton-street, Clerkenwell, Middlesex, clock-case maker. *For an improved ventilator.* Patent dated March 23, 1850.

The improvement specified has reference to that description of ventilator which is composed of strips of wood, metal, or glass, arranged as louvres or luffer-boards. Each end of the strip is attached to a lever pinned near the upper end to the frame of the ventilator. A rod is attached to and connects the levers. This rod is continued and terminates in a handle, so that on drawing the rod down, all the strips will be raised and project outwards. They may be maintained at any required angle by means of a ratchet, into which the end of the rod takes; and on releasing the rod the weight of the strips is sufficient to cause them to descend and close the aperture; or the rod may be raised, and the same object effected. Instead of raising the levers by a rod, the end of the highest lever may be elongated, and have a cord attached to it.

No claims.

EDWARD WELCH, of St. John's-wood, London, architect. *For improvements in fire-places and flues, and in apparatus connected therewith.* Patent dated March 23, 1850.

Mr. Welch describes and claims—

1. A "globular wind guard," which consists of a globe of metal fixed above the top of ordinary chimneys, and surrounded by a casing of similar shape open at the top, and with slits in the sides, whereby a downward current of air is prevented from entering the chimney. A scraper to remove soot surrounds the globe, and is acted on by a vane.

2. An improved method of constructing flue-bricks, by employing four centres to give the requisite sweep to the interior of six bricks, instead of one centre to four bricks, as is at present customary.

3. A downward flue for register grates, by which, on closing the top, the products of combustion are led against the sides of the grate, and additional warmth given to the apartment.

4. An improved detached cooking range, in which heat is imparted from a fire oven by means of metallic casing to stewing plates, &c. This range is detached from the wall, so that the person using it can have free access to either side of the stewing plates, &c.; and

5. An economic cottage oven, constructed by closing with a door the ash-pit or open space immediately under the fire.

WILLIAM JOSEPH CURTIS, of Port of Spain, in the island of Trinidad, in the West Indies, civil engineer. *For improved machinery and apparatus adapted for the manufacture of sugar.* Patent dated March 23, 1850.

Claims.—1. The employment of a hammer or hammers, or stamper or stampers, for the purpose of bruising or crushing canes before submitting them to the rolling mill, whether such crushing apparatus used be in conjunction with or independent of the rolling mill. 2. The employment of a universal joint in cattle sugar mills. And 3. A self-acting feeding apparatus.

2. An arrangement of self-acting apparatus, as described, or any equivalent therefore, for the purpose of regulating the supply of bisulphite of lime and cane-juice.

3. An arrangement of apparatus as described, for the purpose of separating the molasses from the sugar. 2. An arrangement of apparatus for the purpose of equalizing or maintaining the sugar at a uniform level during the process of filling hogsheads. 3. Ramming the sugar into hogsheads by mechanical means. And 4. An arrangement of apparatus for the purpose of regulating the discharge of sugar from the cylinder.

4. A combination and arrangement of machinery for the manufacture of bisulphite of lime, in which sulphur is maintained in a state of combustion by air forced on it, and the vapour or gas evolved conducted to an agitator similar to that employed in gas-works, where it is absorbed by cream of lime. The bisulphite thus formed is drawn off, and a fresh supply of cream of lime introduced.

5. An arrangement of apparatus for the purpose of ladling or transferring the syrup or liquor from one pan to the other.

6. An arrangement of apparatus for the purpose of skimming the pans.

7. An arrangement and combination of

apparatus whereby the teach is shielded or protected from injury by the fire while the teach is being struck or discharged.

8. An arrangement of apparatus by which the pitch or inflammable oils are supplied from the reservoir to be burnt under a steam engine, and also the employment of a force or injection pump therein.

9. An arrangement of apparatus by which the pitch or inflammable oils are supplied from a reservoir to be burnt under the sugar pans, and also the employment of a force or injection pump therein.

10. The sole use of sugar pans electro plated with copper, silver, or other suitable metal, or enamelled with a coating similar to that used in ordinary utensils. And

11. The employment of a web or band and hot air, for the purpose of concentrating sugar at a low temperature.

SAMUEL CUNLIFFE LISTER, of Manningham, near Bradford, York, and GEORGE EDMOND DONISTHORPE, of Leeds, manufacturer. *For improvements in preparing and combing wool and other fibrous materials.* Patent dated March 20, 1850.

The wool or other fibre is first drawn through screw gills, which act as teeth, and then withdrawn in detached portions to be fed into another set of combing instruments. But in withdrawing the detached portions from the first set of combs, the "noil" or refuse, when not nipped by the holder, is left in the comb, and brought forward by the continuous action of the revolving comb, to be deposited and accumulated with the cleaned portions on an endless apron which receives the cleaned portion for piecing.

The patentees refer to a patent granted to J. Hellmann, Feb. 25, 1846, for improvements in piecing wool cardings, in which detached portions of the wool or fibre were held between rollers; whilst one end was cleansed, the continuous action of the rollers presented the second end for the removal of the "noil;" and the wool, thus cleaned, was deposited on combs, and afterwards removed in slivers. The improvement of the present patentees consists in the employment of a series of combs mounted on a cylindrical surface, from which the carded wool may be removed in a continuous sliver.

No claims.

NATHANIEL MATHEWS, of Wern, Tremadoc, Carnarvon, quarry proprietor. *For an apparatus for cutting or dressing slates into various shapes and sizes.* Patent dated March 23, 1850.

The "apparatus for dressing slates" consists of a strong framework, one end of which supports bearings for an axis, to which are affixed two arms, carrying a cutter so placed as to be in every part at an equal distance from the centre line of the axis, but not parallel therewith. A beam across the framing supports a second cutter parallel to the central line of the axis, and placed at a distance from it, which will admit of the first cutter passing without contact. A lever is placed alongside the table, and is expanded at one end into an arch, furnished with internal teeth, into which gears a spur-wheel keyed on the axis of the cutter. The lever has its fulcrum near the end farthest from the workman, so that on raising it, the moveable cutter rises, and on depressing the lever the cutter descends with a sharp blow, and removes the edge of a slate which rests on the lower cutter, and is guided by the workman's left hand. This machine may be employed to cut fancy slates, by having cutters of the required form, and when actuated otherwise than by hand labour, an eccentric and fast and loose pulley may be used instead of the lever before mentioned, to actuate the cutter.

No claims.

HENRY ROBERT RAMSBOTHAM, of Bradford, York, manufacturer, and WILLIAM BROWN, of the same place, mechanic. *For improvements in preparing and combing wool.* Patent dated March 23, 1850.

The patentees describes and claims—

1. The employment of fluted rollers to remove prepared wool from the preparing surface with a draught or drag, whereby the fibres are straightened.

2. An arrangement of the filling head, so that in lashing the wool to the receiving combs, the mouth of the filling head may be parallel, or as nearly as may be, parallel to the plane of the edge of such comb, whereby draught or drag of the fibres is prevented. And also an arrangement of the mouth and roller of the filling head in a slanting or inclined direction, so that the feed-in may be deeper at one end of the head than at the other.

3. An improved method of working gill combs in combing wool.

4. The application of gill combs to the filling head.

5. An improved method of removing "noil" from the combs.

6. A method of heating combs. And

7. An improvement in the means of cleansing gill combs.

JOSHUA SIDDELY, Jun., brassfounder, of Liverpool, Lancaster. *For certain improvements in ships' fittings.* Patent dated March 23, 1850.

Mr. Siddely describes and claims—

1. An improved arrangement of fires and boilers in the caboose, adapted especially to passenger ships, whereby consumption of fuel is economised, and a greater quantity of cooking performed.

2. The adaptation of a metal tube to

support the berths or beds. This tube communicates with the ships' pump and water-tank, and through it water is supplied by a cock to each berth. The water thus supplied may be rendered available for extinguishing fires. And

3. The arrangement of a series of rollers round the central pin of ships' blocks, whereby friction is diminished, the pin suffers less wear-and-tear, and the labour of working is considerably lessened.

John Gedge, of 4, Wellington-street, Middlesex. *For improvements in lamps and candlesticks.* (Being a communication.) Patent dated March 23, 1850.

The present specification refers principally to improvements on the candle lamp, which formed the subject of an expired patent of Palmer's, which improvements Mr Gedge thus describes:

1. A novel construction of reading lamp to be held on the thumb of the person using it.

2. Improvements in apparatus for indicating and measuring the lapse of time by the burning of a lamp.

3. The application of the principle of Argand burners to ordinary candle-lamps. The candle to be used is made hollow, and a tube, round which wicks are placed at regular intervals is inserted. The foot of the lamp has holes pierced for the admission and supply of air. To prevent clogging by the accidental overflow of the tallow, a second smaller tube is introduced inside the first. The disc is perforated in the centre, to allow a passage for the tube, which does not interfere with the helical spring.

4. Improvements in spirit lamps which consists in employing an earthen wick to supply the spirit by capillary attraction to a holder above the level of the burner, in the centre of which it is placed. The spirit is thus heated, and passes downward, partially vaporized, to a second chamber, whence it is supplied to the burners. Slight modifications of this arrangement renders it applicable to burners of any form.

5. A method of, and the apparatus for, regulating the supply of oil to lamps.

6. The employment of an enamelled tube made to resemble a wax candle.

Claims.—1. The employment of a ring with hollow and shade in the reading lamp, as described.

2. The improvements in indicating and measuring the passage of time by burning a candle lamp, as described.

3. The application of the Argand-burner principle to candle lamps.

4. The improvement, above described, in supplying spirit to spirit lamps, whereby they are rendered safer, more perfect combustion of the spirit is ensured, and a better light obtained.

5. Improvements in regulating the supply of oil to oil lamps.

6. The employment of an external casing for burning candles as described.

Specification Due, but not Enrolled.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman. *For improvements in the preparation of materials for the production of a composition or compositions applicable to the manufacture of buttons, knife and razor handles, inkstands, door-knobs, and other articles where hardness, strength, and durability are required.* (Being a communication.) Patent dated March 23, 1850.

Great Atmospheric Wave.—The Spring of 1849 was remarkable for a continuous movement westward of the atmosphere for the space of seventeen days, namely from the 1st to the 18th of February. The mean reading of the barometer during that period was fully half an inch above its average value, and when the crest of the wave was over Greenwich, the reading of the barometer at the level of the sea was as high as 30·90 m. The base of the wave must have been in extent just about equal to the distance from England to America; for it appears from the "American Traveller," published at Boston on 6th April, 1850, that on the same day that it completed its passage at Greenwich, it was felt for the first time at Boston as it was with us. It must have travelled, therefore, at the rate of about 170 miles a day.

A Modern Antique.—The old and exploded scheme of coupling two steam-boats together, and working them by one immense wheel placed between them, has been just revived under the auspices of Messrs. Robinson and Russel, of Millwall, in a vessel called (appropriately enough) the *Gemini*, which made her first experimental trip on Tuesday last. The thing, as might have been foreseen, has proved a decided failure. She took two hours to go from Blackwall to Gravesend against the tide—a distance usually performed under the same circumstances in one hour and a quarter.

The Cologne Bridge.—Some time ago the Prussian Government offered prizes, open to all the world, for the best plan for the construction of a bridge across the Rhine, between Deutz and Cologne. Of 62 plans presented 48 were rejected by the Committee to whom the decision has been referred, and 14 were judged worthy to compete. Eventually two prizes were adjudged; one of 250 golden Fredericks for the plan presented by M. J. G. Schwedler, of Berlin, and the second, of 125 Fredericks, to that presented by Captain W. Moorsom, of London.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Henry Houldsworth, of Cottage House, Lanark, North Britain, iron-master, for improvements in the manufacture of iron and other metals. September 26; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in dyeing yarn, &c., in manufacturing certain woven fabrics. (Being a communication.) September 26; six months.

LIST OF SCOTCH PATENTS FROM 22ND AUGUST TO 22ND SEPTEMBER, 1850.

Thomas Lucas Paterson, Glasgow, North Britain, manufacturer and calico printer, for certain improvements in the preparation or manufacture of textile materials, and in the finishing of woven

fabrics, and in the machinery or apparatus used therein. August 22; six months.

Henry Houldsworth, of Cotness-house, Lanark, North Britain, iron master, for improvements in the manufacture of iron and other metals. August 28; six months.

James Hall, of Geecross. Chester, machine maker, for certain improvements in looms for weaving. August 28; four months.

Robert Westmorland Hutchinson, of Camberwell, Surrey, gent., for certain improvements in saw sets, mallets, and other tools, and in apparatus or machinery for manufacturing same. August 28; four months.

Charles Lamport, of Workington, Cumberland, ship-builder, for certain improvements in machinery or apparatus for spinning or twisting cotton or other fibrous substances. September 2; six months.

Astley Paston Price, of Margate, Kent, and James Haywood Whitehead, of the Royal George Mills, Saddleworth, near Manchester, for improvements in filters. September 2; four months.

Frederick Woodbridge, of Old Gravel-lane, Middlesex, engineer, for improvements in machinery for manufacturing rivets, bolts, and screw blanks. September 3; six months.

Wakefield Pim, of the town or borough of Kingston-upon-Hull, in the county of the same town or borough, engine and boiler maker and builder of iron steam ships, for certain improvements in the construction of boilers and funnels of steam engines. September 4; four months.

William Joseph Horsfall, and Thomas James, both of the Mersey Steel and Iron Works, Toxteth-park, Liverpool, Lancaster, for improvements in the rolling of iron, and other metals. September 6; six months.

George Atwood, of Birmingham, Warwick, copper-roller manufacturer, for a new or improved method of making tubing of copper and alloys of copper. September 6; six months.

Thomas Priestly, of Shuttleworth, Lancaster, manager, and of Richard Hurst, of Rochdale, in the same county, cotton spinner, for certain improvements in machinery or apparatus, to be used for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials; and also in machinery or apparatus for preparing, balling, and winding warps and yarns. Sept. 7; four months.

George Thompson, of 12, Park-road, Regent's-park, Middlesex, gent., for certain improvements in machinery and apparatus for cutting, digging, and turning up earth, applicable to agricultural purposes. September 16; four months.

Christopher Cross, of Fareworth, near Bolton, Lancaster, cotton spinner and manufacturer, for certain improvements in the manufacture of textile fabrics; also in the manufacture of wearing apparel, and other articles from textile materials, and in the machinery or apparatus for effecting the same. September 16; four months.

John James Greenough, of George-street, Hanover-square, Middlesex, gent., for improvements in obtaining and applying motive power. (Being a communication.) September 17; six months.

John Sidebottom, of Broadbottom, Chester, manufacturer, for improvements in looms for weaving. September 18; six months.

James Scott, of Falkirk, Stirling, North Britain, shipwright, for certain improvements in docks, slips, and apparatus connected therewith. September 20; six months.

George Robbins, of Forest-lodge, near Hythe, Southampton, gent., for improvements in the construction of railway carriages. September 20; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Sept. 18	2443	Joseph Guise	Clerkenwell Green	Catoptric deflector and brackets for a gas burner.
,,	2444	Richard Bright	Burton-street, Broad-street	Portable safety carriage-lamp.
19	2445	A. & W. Smith and Co.	Paisley	Centrifugal agitating churn.
20	2446	A. Keep and W. Watkin	Stourbridge	Parts of a vice.
21	2447	F. A. Frinneby	Cannon-street	Oval brush.
,,	2448	H. J. and D. Nicoll	Regent-street	Inner lining or wadding for garments.
,,	2449	S. Harrison	Stanhope-street, Clare-market	Ventilator.
24	2450	J. G. Taylor	Great St. Thomas Apostle	Safety mount for fastening.
25	2451	W. J. Epps	Maidstone	Sulphurator.
26	2452	George Boulton	Great Dover-street, Borough	Globular shield pin.
,,	2453	William Cutler	St. James's-street	The duplexa coat.

CONTENTS OF THIS NUMBER.

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Edited by J. C. Robertson, 166, Fleet-street.

SYKES'S PATENT WICK-SUSPENDING AND CUTTING APPARATUS.

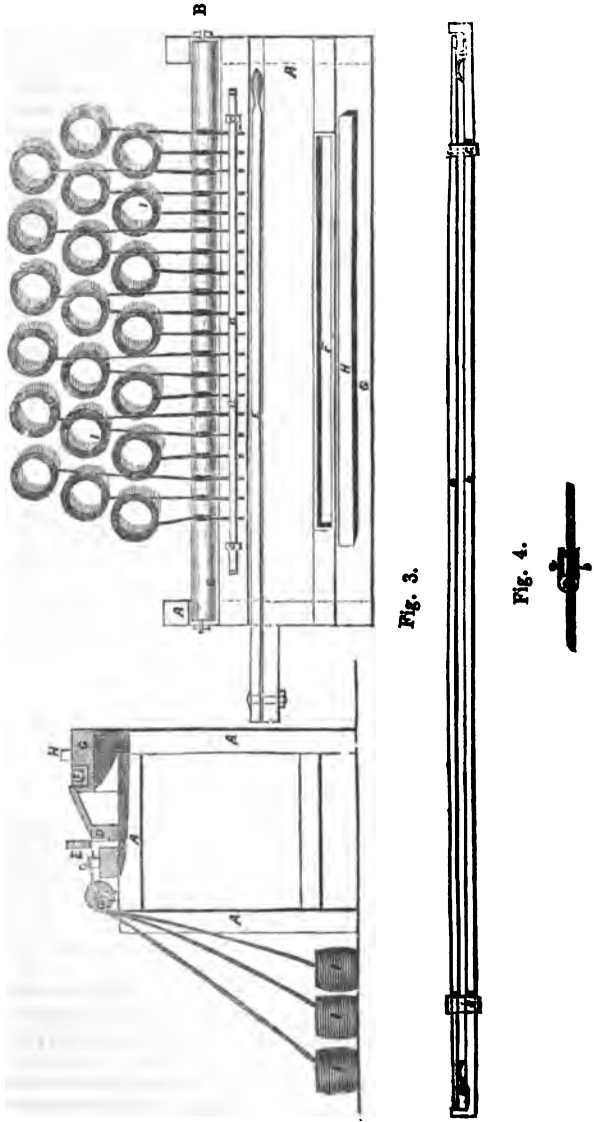

Fig. 1. Fig. 2. Fig. 3. Fig. 4.

SYKES'S PATENT WICK-SUSPENDING AND CUTTING APPARATUS.

FIG. 1 of the prefixed engravings represents a plan, and fig. 2 a cross-section of the ingenious apparatus to which we referred in our last as having been invented by Mr. William Sykes, of York-street, Westminster, for suspending and cutting the wicks, in the manufacture of dipped candles. AA is a framework; B a grooved roller over which the cords of twisted or plaited cotton are passed from the bobbins, I I; C is a clip or holder (a front elevation of which is given separately in fig. 3), which consists of two principal pieces or bars *a* and *b*, which are held together by means of two sliding clamps *c c*. D and E are the blades of the scissors or cutter, the former being fixed and the latter moveable. F is a trough for containing a liquid cement composed of stearic acid, wax, tallow, or any other suitable ingredients, which is kept in a melted state by a jacketing of hot water, or air, or steam; and G is a table which supports the broach or rod H, by which the wicks are suspended during the dipping process, and which is made square instead of round as usual. The mode of operation is as follows:—The cords are brought down from the roller B and secured between the bars *a* and *b* of the clip or holder C, each cord being left projecting about an inch in advance of the front edge of the clip. The bars *a* and *b* are made to lay firm hold of the cords of cotton by moving the sliding clamps, *cc*, from the ends inwards, which brings the bars in consequence of the wedge-shaped ends of the upper bar *a* closer together. The cords being thus secured, the clip is lifted up, and drawn forward by the workman, after which the free ends of the cotton which were left projecting from the clip are immersed in or brushed over by the cement in the trough F, and then laid on the top side of the square broach or suspending-rod H, to which they are then made by a slight pressure to adhere with sufficient firmness for the after process of dipping. The clip is now slackened, which is done by moving the clamps *cc* outwards, and pushing them sufficiently far back over the cotton and towards the bobbins as will suffice to form the intended lengths of wick. The clip is then, by a reverse movement of the clamps, *cc*, again made fast upon the cottons and placed upon the table K, being about one inch behind the cutter. The moveable blade E of the cutter is next brought down and cuts off the cottons, leaving them adhering at the near end (by means of the cement) to the suspending-rod or broach H. The broach H, with the wicks thus adhering to it, is next placed in a dipping frame of the usual construction; and so other broaches are similarly filled, as many as may be required one after the other.

The two bars of the clip C may be hinged, so that when opened they shall allow the cotton to go free, but when closed will take a firm hold of them, as shown in the cross section fig. 4.

GEOMETRICAL NOTES. BY T. S. DAVIES, ESQ., F.R.S., F.S.A., ETC.

(Continued from page 174.)

II. *On some of the Fundamental Principles of Geometrical Reasoning.*

Several of the subjects which enter into the preceding inquiry, as to the extent to which the Greeks had carried their researches and settled the "science of method," have yet to be discussed; but as I am only publishing my "notes," not a systematic work, I must be permitted to give them nearly in the order in which I originally drew them up—with no other bond of connection than the accidental one of the particular course taken by my own thoughts. This might occasion now and then repetitions of the same argument, or of the same phraseology; but, these being associated with new adjuncts, and directed to different purposes, will hardly be deemed mere tautology. Should these, however, or even greater faults than these, occur, I hope I may safely bespeak the indulgence of my candid reader, and shall very resignedly submit myself to the censure of the uncandid.

At the close of the preceding section, some remarks were made on the use of formal logic in geometry. Several other aspects of the question respecting the essence of mathematical reasoning might be found. Where they are immaterial to the purity and progress of geometry,

it does not fall within my plan to notice them; but a few very pernicious errors which prevail widely amongst classes of the semi-learned in such matters, must be examined at sufficient length for the purposes of correction.

It certainly seems strange that in our own day there should exist a moment's debate upon such doctrines as those to which Dugald Stewart and Colonel Thompson have given celebrity, and even partial currency. They both agree in this—that *it is not upon axioms, but upon definitions, that the structure of scientific geometry is to be raised.*

It has been the fashion, since the adoption of the doctrines of Locke in this country, to look with superlative contempt upon everything approaching in form or effect to the logic of Aristotle; so much so, indeed, that (though it has *formally* retained a place in the educational syllabus of one of our universities) the judgment of any man is at once impugned who shall venture to make the least allusion to it in the course of a discussion. Practically, logic is rather classed as one of the follies of the middle ages, and consigned to the same oblivion as "the occult sciences," than as an organon for the discovery or establishment of deductive truth. The absurd parodies upon the application of the syllogism, which seem to have been treasured up with unusual care, have no doubt much to do with this effect; but yet, that sensible and cultivated men should class the system amongst the idle and contemptible heterodoxies of science, is almost unaccountable. *Common sense* is now set up as the universal arbiter between truth and falsehood. "A man of one subject" is now a rarity; "all men are all things" in this happy intellectual era! No man must be unable to talk on all possible subjects, if he would maintain his social position and character for ability. The most profound acquaintance with any one subject, or even of several collateral ones, confers little popular reputation in these days. A man must be everything, or he is nothing! That man must possess a good share of moral courage who can venture to acknowledge his ignorance of any one of the recognized subjects of cotemporary scientific interest. We are, indeed, fast verging towards a race of "dabblers and gabblers." "Common sense" is the organon by which such wonders are wrought; for it is most piously believed that the application of this engine to a few facts collected at random, is sufficient to render its possessor a full-blown man of science. Even men whose acquaintance with some one or more sciences is really profound, and who will not admit the raw material of common sense to exclude specific methods of research *in those particular sciences*, will yet contend for its paramount authority in all others.*

* The following observations of Dr. Whately are both pertinent and judicious:—

"But many who allow the use of systematic principles in other things, are accustomed to cry up common sense as the sufficient and only safe guide in reasoning. Now, by common sense is meant, I apprehend (when the term is used with any distinct meaning), an exercise of the judgment unaided by any art or system of rules;—such an exercise as we must necessarily employ in numberless cases of daily occurrence;—in which, having no established principles to guide us—no line of procedure, as it were, distinctly chalked out—we must needs act on the best extemporaneous conjectures we can form. He who is eminently skilful in doing this, is said to possess a superior degree of common sense. But that common sense is only our *second best* guide,—that the rules of art, if judiciously framed, are always desirable where they can be had, is an assertion for the truth of which I may appeal to the testimony of mankind in general, which is so much the more valuable inasmuch as it may be accounted the testimony of *adversaries*. For the generality have a strong predilection in favour of common sense, except in those points in which they, respectively, possess the knowledge of a system of rules; but in these points they deride any other who trusts to unaided common sense. A sailor, *e. g.*, will perhaps despise the pretensions of medical men, and prefer treating disease by common sense; but he would ridicule the proposal of navigating a ship by common sense, without regard to the maxims of nautical art. A physician, again, will perhaps contemn systems of political economy, of logic, or metaphysics, and insist upon the superior wisdom of trusting to common sense in such matters; but he would never approve of trusting to common sense in the treatment of diseases. Neither, again, would the architect recommend a reliance on common sense alone in building; nor the musician in music, to the neglect of those systems of rules which, in their respective arts, have been deduced from scientific reasoning aided by experience. And the induction might be extended to every department of practice. Since, therefore, each gives the preference to unassisted common sense only in those cases where he himself has nothing else to trust to, and invariably resorts to the rules of art wherever he possesses a knowledge of them, it is plain that mankind universally bear their testimony, though unconsciously, and often unwillingly, to the preferableness of systematic knowledge to conjectural judgments."—*Logic*, p. 14—16.

It is just thus when the practical man treats mathematical science with contempt, and only this occurs when he knows too little of the value of science to estimate its worth, and too little of its processes to be able to use them. It is just thus, too, when the mathematician, in his turn, looks with disdain on the syllogism—proving thereby rather his ignorance of its nature and functions, than the superior development of his common sense. All his processes are ratiocinative; and yet he rejects all inquiry into the validity of the inferences which he draws, and

I anticipate being able to show that, besides the hostility to which the Aristotelian syllogism was subjected in the school of Plato, on the ground of mere sectarian faction, there were other and very cogent reasons which deeply affected the metaphysical creed of the Platonists. A more suitable place than the present will occur, farther on, for the discussion; and I shall here merely suggest one or two considerations respecting the *principle* of those attempts which, age after age, have been made to build up a system of "geometry without axioms."

What is the character of geometrical reasoning? Take any step of the process at pleasure, after the very earliest ones, can we find a single exception to this rule:—the inference of a third truth from the previously admitted truth of some two antecedent ones? And what is this but a syllogism? One of its premises, indeed, may be suppressed as was done by Euclid and the antients, or it may be supplied by reference, as is now generally done in all edition, of Euclid: but, however, this may be, the process is, in its essence, a syllogistic one.

I have already remarked (p. 174) upon one feature in which the syllogism essentially differs in its mathematical applications from all others:—that *it expresses equality, inequality, or some conception which involves these, and not strict identity.* To me it appears, indeed, that these circumstances ought to be made (in mathematical logic, I mean) *a part of the copula itself* rather than of the predicate of the proposition. As far as I know. I am peculiar in this view, and therefore express it with due diffidence: but still it is not a view of yesterday's formation. I have examined it again and again, in every way I could devise. The greatest objection that I can anticipate is—that it would sever the *formal application* of logic to mathematics from all its other applications; and thus create two systems of logic instead of one; or at least a general and a special system. As a mathematician, however, this would be of little weight with me; but as a man of science looking to the general principles of scientific method, it appears to me to be matter of considerable importance, and gives rise to many interesting speculations.

There is a popular notion, which has been afloat from immemorial time, that there is *some peculiarity* in the mathematical demonstration, which distinguishes it from all other modes of proof —and which is more conclusive than even the conclusions of the indisputable "common sense." Nothing is more common, even now, than to hear a debater affirm that he has "proved his proposition to [by] a mathematical demonstration." Of course, persons who employ such phrases are not for a moment supposed to understand in what this, to them, conclusive mode of proof consists, or in what it differs from any other mode. They merely mean that they have placed the debate in such a position that the conclusion is irresistible, and nothing more. It shows only this, that somehow or other, there is a very general admission made by common consent, that the conclusions of mathematical science are, incontrovertible.

There is yet a more intelligent and cultivated class of minds—literary men in general—who take the same general view as to the conclusiveness of mathematical reasoning. They, however, entertain the idea that it has in its logic something peculiar to itself, or else that its subject-matter removes it from the sphere of ordinary logical evidence. In these, or some such conclusions they rest satisfied, and further inquiry is deemed needless. Against this view, logical writers have strongly protested; and with an earnestness that proved their estimation of the importance of the question.

There does, however, after all, remain that striking difference between the *copula of equality* and *copula of identity,* to which I have referred; but upon which logical writers (studiously one would be almost led to believe) avoid all remark or explanation. Might not something be due to this, as well as to the

all investigation into the laws which govern *inevitable conclusiveness.*

Logic, indeed, when divested of the silly accretions of the schoolmen, and confined to its legitimate purpose, is nothing more or less than *the philosophy of just inference.* It simply investigates the circumstances under which a conclusion is legitimately inferred from the premises, and guards against assuming, as common sense so often does, that a proposition is true (not in itself, but) as dependent on the reasons assigned. *It has nothing whatever to do with the truth of the premises—only with the validity of the inference from them.* See De Morgan's "Formal Logic," Pref. and elsewhere.

subject-matter of mathematics—space and number?

But to return to the "geometry without axioms," (or, as it has been considered,) "the geometry of Euclid made perfect," we shall be able to dispose of this question summarily.

Every geometrical argument is composed of three members, *expressed or understood*—the major proposition, the minor proposition, and the conclusion. One of these propositions is invariably a *previously-admitted* truth, and the other the hypothetical condition of the theorem, or some conclusion deduced from a comparison of it with another previous truth. Open the "Elements," where we may, and take any part of any demonstration we please, we shall find this to be verified; and so far, without any disputation respecting the copula too, we shall find that the general system of Euclid in this respect conforms to the ordinary logical rules.

By retracing our steps from any assumed stage in a system of geometrical development, our number of *previously-demonstrated truths* for appeal becomes gradually contracted. Whatever be the developed system—Euclid's, Legendre's, or even Colonel Thompson's—we must at length come to a *first demonstrated truth*. How, then, was *this* demonstrated, seeing that there was no antecedent one to form the major premis of the demonstration? The system is abruptly broken here—the chain is detached from all support—the "gigantic tortoise that supports this world" of intellect, is itself "supported by nothing." The truth is, that we *assume the wanting premis* in this case, taking care that it shall be so simple and obvious that even "common sense" shall not, with all its "sharpened wits," be able to dispute it. In short, *we make an axiom;*—and we make it because we cannot proceed a single step without its aid.

It is, indeed, true that even of the axioms really used by Euclid himself, a small number only of them are put down formally. Occasionally, they are expressed in the places where their use occurs, as in the earlier part of *i.* 4; but more frequently, they are tacitly assumed without any remark whatever, as, for instance, in *i.* 10, where it is *assumed* that the line which bisects the angle ACB will meet the line AB. Euclid might, it is true, conformably with his general aim at spiritualizing geometry, have wished to diminish his number of axioms, as he did the applications of supraposition, and the employment of motion generally; but there is no reason to think he ever contemplated getting rid of them altogether. In all cases we can, therefore, only look upon *his* assumption of them, like the last referred to, as an oversight. If, however, so cautious a writer as Euclid could commit numerous such oversights, whilst he practically admitted the necessity of the axiomative class of propositions, we can scarcely wonder that men of less disciplined minds, *who set out determined that there shall be no axioms*, should commit more serious oversights of the same class. This, in fact, is their whole secret—that of *foisting in tacitly* a series of axioms tantamount to those of Euclid, though differently expressed. It would be very easy, were it worth while, to show that in every attempt to dispense with some special axiom by a long course of reasoning, some axiom tantamount to that with which it was proposed to dispense had been tacitly assumed in the course of the process. The 12th axiom of the first book of *Euclid* is a notable instance. There is no one of them, perhaps, which we should hesitate to receive *as an axiom;* and we should judge of their value, not by the greater or less clearness of our conviction (for there is seldom much difference in this respect), nor by the neatness of their conception or expression, but by the facility with which they contribute to directness, simplicity, and brevity of the demonstration into which they enter as component parts. My own objection lies against the fundamental mistake—that if no axiom be formally enunciated, no axiom is used. Neither, but for the confusion it invariably creates in minds little disciplined (and therefore always ready to seize upon any outrageous notion which more steady-going philosophers deem heterodox) with respect to the fundamental principles of rational evidence, should I deem it of so much importance to inculcate a correct view of this question.

The views of Dugald Stewart* on any

* See the "Philosophical Magazine" for September, 1850. All the papers left by this distinguished metaphysician and philosopher, together with all those of his illustrious father, Dr. Matthew

subject must always be—for his was a mind that looked to principles—treated with becoming respect. His conclusion was, that *geometrical demonstration ultimately resolved itself into dependence on definitions, and not on axioms;* and that wherever an axiom made its appearance of necessity, it was *only a definition in disguise.*

For instance, he considers the 8th axiom to be the *definition of equality,* the 10th as the *definition of a straight line,* the 11th as the *definition of a right angle,* and the 12th as *a demonstrable proposition.*

It will be more convenient to discuss such questions as these when we come to a direct examination of the construction of "Euclid's Elements;" and merely to give in this place a few general remarks on the system proposed by the Edinburgh Professor.

Definitions are often said to be of two kinds—of the word, and of the thing. It appears to me not quite accurate, as long as the word is otherwise used, to call the former a definition at all. It is merely a synonym—the predicate of the proposition which affirms synonymity being a single term, or an assemblage of several. Without, however, pursuing this question, or even disputing upon the cases above cited, sufficient reason for the rejection of the proposed system may be deduced from more general considerations.

A definition, to be perfect, must contain a clear description of the conditions that properly limit "the subject:"—that make it what it is,—neither less nor more. If the conditions be too few, innumerable subjects besides the one intended to be defined would be included, and the definition, as such, would be indeterminate. If, on the other hand, there were more conditions than these, they would at least be superfluous (like Euclid's definition of similar polygons); and the superfluous may be incompatible with the essential ones; and therefore the definition so formed would be that of a subject whose existence might be impossible. All the conditions which we include in the definition of a subject, beyond those which properly and inevitably limit it, will be, if consistent, properties of it, and if inconsistent, still alleged properties, but erroneously so alleged.

But can we not give two separate and independent definitions of the same entity? Can we not then compare these two, and thus deduce a series of legitimate consequences? Let me ask, in return—how is it to be known that these separate definitions are those of the *same subject?* The subjects can only be known to be the same, *in initio,* by *sameness of definition.* If the difference between two definitions be only formal, or merely in the expressions employed, they are virtually but the same, and no truth can be legitimately deduced from a mere grammatical change. If, on the contrary, the conditions in the two cases be essentially different and independent, there is nothing whatever but mere assertion to show that they are both definitions of the same subject. The condition in one definition, that is not also in the other, is never anything more than *axiom,* covertly assumed and unjustifiably brought in. It may, indeed, be a demonstrable proposition, but in its mode of introduction, it is *essentially* made an axiom; and thus, besides a confusion of the first principles of geometry, there is also a depravation of its logical process involved in this attempt to found geometry on definitions only. As an instance, let us take the *hyperbolic paraboloid,* or *plan gauche,* of which two definitions have been usually taken by the French geometers, and one or other of these employed (even by the same writer), according to the facility with which it conduced to the proof of any specific ulterior property. As the surface was a generated one, either genesis might be legitimately employed; and even had the surfaces bearing those separate names not been classed as identical, both might have been used. But when the surfaces generated by the two modes (by a line resting on two given lines, and being always parallel to a given plane—and as that formed by the motion of a line which always moved on three given lines, these given lines being parallel to one plane), were called by one name, or called the definitions of the same thing, the process was no longer legitimate. The surfaces generated by the two methods being identical is thus virtually assumed, *or made an axiom;* and, indeed, if we judge by the seeming reluctance of our

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Stewart, have been wantonly destroyed—aye, *worse than wantonly!*

neighbour-geometers to enter upon any attempt at demonstration, we should be led to think that it involved some extraordinary difficulty. That the proof is simple enough is evident from what is done on this subject in the forthcoming and final number of the "Mathematician;" and the adoption of the opinion of the two surfaces being identical, is characteristic of the "off-hand method of inference" which, amongst the French geometers, is analogous to our own "common-sense logic," from which, happily our geometry itself has kept pretty much aloof, though our analysis has only partially done so.

We may conclude, then—

(1.) If two definitions of a subject be virtually identical, no syllogism can be founded on them, and hence no geometrical conclusion derived from them, without the aid of an axiom.

(2.) If they be essentially different, they can only co-exist, the one as an inevitable consequence of the other;—either as a *direct axiom* asserting the identity of the subjects defined, or the one dependent on the other as the result of mathematical demonstration.

(3.) No system of geometry can be built upon *definitions alone*, *without the assistance of axioms*, in the ordinary sense of the word.

(*To be continued.*)

A SHORT MEMOIR OF REUBEN BURROW, THE MATHEMATICIAN. BY THE LATE J. H. SWALE, ESQ., OF BRUNSWICK-PLACE ACADEMY, LIVERPOOL.

Sir,—When the late J. H. Swale published his valuable "Geometrical Amusements," in 1821, he observed (page 129), "of Reuben Burrow—that distinguished, elegant geometer, and able mathematician—I am not aware that, even the most humble memoir has yet been given." Sympathy with a kindred genius appears to have induced Mr. Swale to attempt to remedy the defect; and the following short memoir may be considered as a tribute of esteem to Mr. Burrow's eminent attainments in geometrical science. The memoir itself was probably intended for publication in the *Liverpool Apollonius*, had that excellent periodical been continued; but as such was not the case, the MS. has ever since remained in the possession of his son, the present J. H. Swale, Esq., of Liverpool, with whose kind permission I have great pleasure in forwarding a verbatim transcript for insertion in the *Mechanics' Magazine*. It may here be mentioned, that Mr. Swale has transferred the whole of his father's MSS. into my possession with full permission to make them public. Their *general* character will shortly be described by a gentleman whose exertions in the cause of science are beyond all praise, and I hope in course of time, if health permits, to be enabled to make Mr. Swale a suitable return for his generosity, and add considerably to his father's already extended fame.

T. T. WILKINSON.

Burnley, Lancashire, September, 26, 1850.

Memoir.

Reuben Burrow was born on the 30th of December, 1747, at Hoberly, near Shadwell, a village about five miles north-east of Leeds in Yorkshire. His father, who occupied a small farm in that neighbourhood, was in low circumstances, but by his industry he raised a family of eight children, and his integrity and character were unimpeachable. The subject of this brief memoir was, at five years of age, put under the care of an old woman at Shadwell to learn his alphabet, and reading made easy; these he soon mastered, and his father was then told by his old preceptress that Reuben must now have some abler teacher, as she had exhausted her stock of information. He was sent to a master at Wike, who taught reading and writing; the old man at the end of three months, finding his scholar very apt and successful, made the same declaration as the old woman, and Reuben was now kept at home until the year 1758 or 1759, when his father removing to a larger farm at Roundhay, near Leeds, an agreement was made with a neighbouring schoolmaster, to send him a day or two occasionally when he could be spared from the labour of the farm. The time he continued to be instructed in this way is not exactly known, but it could not have been long, the charge made being only 2s. 6d.; however, during this term he had advanced into Division. After continuing at home again

about two years, he was sent for three or four months to a Mr. Grimshaw, who kept a respectable boarding-school in the vicinity of Leeds. What application or what progress he made in other studies I have not learned, but he appears to have gone through the principal parts of common and decimal arithmetic while under the care of Mr. Grimshaw. His assistance in the farm was again required, and, of course, his studies were once more discontinued; but Reuben's ardour was not to be repressed—he again prevailed upon his father to send him to school; and he was now placed with a Mr. Crooks, master of a commercial and mathematical school at Leeds. Mr. Crooks perceiving the capacity of his pupil, found himself attached to him and interested in his progress. He now applied himself to bookkeeping, trigonometry, geometry, algebra, fluxions, and in less than three months had made some acquisition in each. Being desirous of trying his fortune in London, a friend procured him the situation of under-clerk to a timber-merchant; he went a few days to Mr. Crooks to make himself perfect in the mensuration of timber, and then set off for London; this was in July, 1765,—he being now in his eighteenth year. He appears to have performed nearly the whole distance on foot; as I find a minute of the total expense, amounting to 1s. 10d.! Time 3¼ days!—Distance 200 miles!!!

He left the timber business at the end of a year, and engaged as teacher in a school in Bunhill-row: he soon after went to Portsmouth, and there opened a school for himself. About the year 1770, he seems to have given up his school, and engaged as engineer to a settlement that was projected in the Isle of Borneo; but this engagement proved abortive, through the failure of the project. A ltttle subsequent to this, we find him situated at Greenwich, as Assistant Astronomer to Dr. Maskelyne; he continued there about two years, when, having taken to himself a wife, and concluding that his present emoluments would not meet his certain and probable exigencies, he opened a boarding and day-school at Greenwich. I am not aware with what success he met; but from his general habits and other circumstances, I conclude it was by no means flattering, since, in 1774, he was associated with Dr. Maskelyne, in Perthshire, instituting a series of observations and surveys on the mountain Schiehallion. Some ground of difference seems to have arisen between him and Maskelyne before the completion of their inquiries; for, by Burrow's memorandums, I find he was left (or at least he chose to stop) to finish several matters which Mr. Burrow mentions as essential to the survey. In doing this, he states particularly the circumstance of the doctor having denied him the use of a theodolite and other necessary instruments. What were the doctor's foibles I know not, but I am apprehensive that Burrow's natural composition afforded nothing very conciliating—so that between the buckram of divinity, tinselled with F.R.S., and the unqualifying republican stiffness of conscious talent, discordance might be reasonably expected. My memorandums say, that after this he was made teacher of the mathematics, at the drawing-room in the Tower; but from a statement of his own, respecting the emoluments, it appears to me that he attended the Tower during the time he was at the Royal Observatory. However, in 1782, at the instance of Col. Henry Watson (his warm friend and patron), he relinquished all his engagements in this country, and went to India (I suppose in the capacity of civil engineer to the East India Company); where he continued to the time of his death, which took place at Buxor, on the 7th June, 1792, in the 45th year of his age.

Mr. Burrow, as a mathematician, attained considerable eminence;—as an elegant geometer, in particular, he stands highly distinguished. From 1776 to the time of his departure for India, he edited an Almanack, published by T. Carnan; the mathematical department of which is curious and valuable.* He also published a small tract on "*Projectiles, and a Restitution of Apollonius on Inclinations*," in 4to.; both of which rank him as an able geometer. During his residence in India, he published several valuable papers in the "*Asiatic Researches*;" and had his life been spared, his labours, I have no doubt, would have

* For an account of this interesting serial, reference may be made to my contributions to the history of "Mathematical Periodicals," No. xvii., in Nos. 1362—4—6 of this Magazine.—T. T. W.

materially enriched the mathematical sciences.*

Mr. Burrow maried Anne Purvis, daughter of Mr. Purvis, wholesale poulterer in Leadenhall-street; by her he had four children—three daughters and a son, all of whom followed him to India in 1790. Some time after his death, they returned to London, where the wife and two daughters died soon after;—the remaining daughter married. The son obtained a lieutenancy in the Company's service, and returned to India, where he died. I have not been informed whether Mr. Burrow's son inherited a portion of the father's mathematical talent; and as genius has not yet by Act of Parliament been made hereditary, I am at a loss to determine.

Mr. Burrow in private life had some of those eccentricities which frequently attend genius, though by no means necessarily. After the rites of Bacchus had roused his energies, I am told he would not hesitate on some occasions to enter the lists of pugilism; and from his bodily powers, I apprehend he was an antagonist rather to be feared than despised. The protracted and midnight revel were not uncongenial to the early habits of Reuben, though those habits were far from dissipated. His natural powers were great, but his education very defective. His heart was good, but his habits had been formed by casualty and the necessity of the moment, rather than by design and the prudent hand of a master.

John Henry Swale.

* One of these papers has reference to the Hindoo knowledge of the Binomial Theorem; and another is entitled some "Hints Relative to Friction in Mechanics." The last-named paper has been reprinted in vol. ii., pp. 204—220, *Leybourn's Repository*, old series; and also in the *Gentleman's Mathematical Companion* for 1800.—T. T. W.

CHEAP COOKERY.

Sir,—From the time of Count Rumford many have been the cottage stoves, economical ranges, and fire-places that have been introduced,—some of them great improvements on former ones; and lastly, Monsieur Soyer's magic stoves; yet none of those hitherto on sale are calculated to dispense with attendance on them,—an important consideration with the labouring classes. Experience, notwithstanding, has ascertained the practicability of forming a cooking-apparatus easily set to work, and after that requiring no farther attention for many hours. It happened some years ago that two young men—laboriously employed as learners in a great manufactory, with pay of a shilling a day—determined to confine their daily expenses within that small sum. Dinners at their lodgings as gentlemen,—for such they were,—was out of the question; so was dining at any chop-house, to say nothing of the attendant loss of time and temptations to idleness and dissipation; they decided therefore on cooking for themselves, on working days. For this purpose they contrived a little tin apparatus, well jacketed, and heated by a lamp, which they set to work before going to the manufactory in the morning; at their return home at one o'clock a dinner was found ready, hot, savoury, and nourishing. A variety of meats were thus cooked; the favourite dish was mutton stewed with rice, which came to less than sixpence a head,—oil for the lamp, and seasoning for the stew included. These gentlemen are now amongst the most prosperous, and distinguished for skill, in the branch of mechanical business in which they are engaged. It is not however for persons of this description that an economical self-acting cooking-apparatus is most desirable, but rather for females, who, to earn their daily bread are away from home, excepting at their meal-times—though many a young man would fare the better by the use of it, at the same time that it might enable him to lay by a something considerable against marriage, or a rainy day.

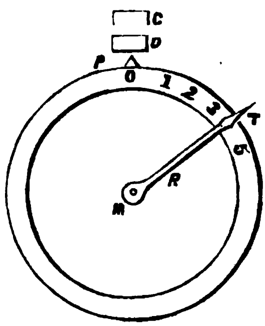
A cheap apparatus of the nature in question, would probably be best of pottery-ware: Monsieur Soyer's magic stove is advertised at thirty-five shillings—too great a sum to be afforded by laundresses, washerwomen, &c. In France, portable furnaces for cooking with charcoal are made of fire-clay, and bear a heat far exceeding that of a lamp; these *fourneaux*, as they are called, are sold retail in great numbers, at so little as twelve sous (sixpence) each, furnished complete with an iron grating to support the charcoal, and with a band of iron round the stove to prevent its cracking. The cooking vessels in general use in that country, even for many purposes in superior kitchens, are also of pottery, though of another description, and of different shapes, sizes, and prices from

a penny a piece upwards. For long-continued cookery, pottery is superior to metal as transmitting heat less suddenly, and retaining it longer. Earthenware vessels are more easily cleaned than metal ones, especially where a lye of either wood, ashes, or soda can be used for washing them.

In the Museum of the Royal Botanic Garden at Kew, there are specimens of pottery from Para, which neither break nor burn in the fire. The clay of which they are made is said to be mixed with the ashes of the caripa, or pottery-tree. The effect of mixing wood ashes with potter's clay might be worth a trial.

M. S. B.

ELECTRIC TELEGRAPHS — PHOTOGRAPHIC REGISTERING MAGNETIC INSTRUMENTS —VAPOUR AND STEAM.



Sir,—In No. 1409 of your present Volume there is a notice of a patent for some improvements in Electric Telegraphs—and amongst the abstracts of claims is the following :—

"8. An arrangement for sounding one out of a number of alarums."

It is impossible, of course, to infer from this brief notice what are the particulars of the invention, and I am not aware of the mode at present adopted. If there be none, by which one only out of a number of stations may be signalled, then I would propose for consideration a plan for effecting this desirable object which occurred to my mind some time ago.

Let the above figure represent a wheel, with marks 1, 2, 3, and 4, at equal distances on the circumference, and corresponding in number to the whole number of stations, say 60, connected by telegraph.

Let the axle of this wheel be made to turn once in a minute by clockwork, and the wheel be so placed on the axle that so long as a detent D rests on a projection P (opposite to the mark O), the wheel shall be at rest; but when D is lifted (by electricity), the wheel shall have sufficient friction-hold on the axle to cause it to turn round in the same time—that is, once in a minute. Now let R be a radial arm, capable of being placed at any of the marks 1, 2, 3, &c., and furnished with a projection T, which shall always pass free of D, but be caught by a catch C, provided that catch descends when T is within a certain distance on either side of the line CM. The catch C is supposed to be moved by electricity, and if it falls so as to strike T, the wheel will be stopped, a certain circuit completed, and a bell rung; but if C does not fall on T, it will be wholly inoperative on the machine.

A wheel, similar to that described, should be at every station, and in general the radial arm R at each station should be left opposite to the particular number denoting that station.

Thus the arm R, at No. 2 or No. 27, will be at angles with the line DM, particularly representing such stations respectively.

Supposing magnets, circuits, and bells to be so arranged that the bell of each station shall be set ringing only when a current is completed through C and T, we may describe the action of the instrument as follows:

If station No. 20 *requires to correspond with No.* 35, then—

1. Put the arm R opposite the mark 35 on the rim.

2. Send a current along the wire which will release the detents D *at all the stations*, and all the wheels will commence moving (at nearly the same rate.)

3. When the point T comes under C (that is in 35 seconds), the similar point at station No. 35 will then be beneath its catch; therefore, send another current along the line, which will affect only wheels No. 35 and No. 20, and will ring the bell of 35.

4. After the communication of the message, return the wheels 20 and 35 to their original position. All the other wheels will have gone round for *one minute*, and will *themselves* have come into the exact position they were in at first.

By this means the average time (in

the above supposed circumstances) required to signal one station would be half a minute; but if that should be thought too long (!) the wheels might move at double the proposed rate, and the convenience of this plan will depend on the time of revolution of the wheels, and the amount of margin which can be permitted on either side of a perfect agreement of their motions.

We shall see that a comparatively inaccurate adjustment would not impair the usefulness of this simple apparatus; for if the catch C were made of such a breadth as to operate on T when it is at the distance from the line MC, represented by *nearly* half an interval on either side of that line, an error of nearly half a second in a minute may be allowed without deranging the instrument.

In your notice of the last meeting of the British Association, I observe mention made of some magnetic-photographic, self-registering instruments, and that this application of light has been successful at the Kew Observatory. About five years ago I thought of the same mode of registering magnetic disturbances, and I wrote on the subject to Lord Rosse and Dr. Lloyd.

Perhaps some of your readers are acquainted with the Kew instruments alluded to, and a description of them would probably be interesting to others as well as to myself.

Will any of your correspondents give a good definition of "steam," particularly distinguishing it from "vapour?" The only one which occurs to me is this:—"When heat imparted to water no longer raises the temperature of the water, but is wholly absorbed in the production of vapour, the vapour thus evolved is called steam." But this definition is faulty when we suppose artificial pressure to be applied to the water. Can water be said to exist in four states—solid, liquid, vapour, and steam?

I am, Sir, yours, &c.,

JOHN MACGREGOR.

Howth, Sept. 14, 1850.

ON THE LUNAR SURFACE, AND ITS RELATION TO THAT OF THE EARTH. BY MR. NASMYTH.

The vast number and magnitude of crater-formed mountains with which every portion of the Moon's surface appears to be covered, has led Mr. Nasmyth to the conclusion, that these crater-formed mountains are really the craters of extinct lunar volcanoes; pointing out the frequent occurrence of the central cone, the result of the last eruptive efforts of an expiring volcano, a feature so familiar to all those who have observed volcanic craters on the Earth's surface. This central cone Mr. Nasmyth showed to exist in the majority of the lunar craters; and thereby drew the conclusion, that they were the result of the same kind of action which has produced them on the volcanoes of the Earth. The cause of the vast numbers of such volcanic mountains with which the lunar surface is bespattered was next considered, and traced to the rapid consolidation and contraction of the crust of the Moon; whose mass or bulk being only $\frac{1}{49}$ of that of the Earth, while its surface is the $\frac{1}{13}$, has, in consequence of these proportions, a radiating or heat dispensing surface four times greater than that of the Earth in relation to its bulk. From this geometrical consideration Mr. Nasmyth explained how it was that by the rapid cooling and collapse of the crust of the Moon on its molten interior, the fluid matter under the solid crust was by this "hide-binding" action forced to find an escape through the superincumbent solid crust, and come forth in those vast volcanic actions which in some remote period of time have covered its surface with those myriads of craters and volcanic features that give to its surface its remarkable character. The cause of the vast magnitude of the lunar craters was next alluded to; and assigned, as in the former case, to the rapid and energetic collapse of the Moon's crust on its yet molten interior, —the action as regards *the wide dispersion* of the ejected matter being enhanced by the *lightness* of the erupted matter, seeing that the force of gravity which gives the quality of *weight* to matter on the Moon as on the Earth is so very much less on the surface of the Moon than on the Earth,—so that the collapse action had to operate on material probably not half the weight of cork, bulk for bulk. The causes of those vast ranges of mountains seen on the Moon's surface was next touched on; and Mr. Nasmyth endeavoured to explain them by the continued progress of the collapse action of the solid crust of the Moon crushing down or following the contracting molten interior, which by the gradual dispersion of its heat, would retreat from contact with the interior of the solid crust, and permit the crust to crush down and so force that portion of the original surface *out of the way*, and in consequence of this action assume the form and

arrangement of mountain ranges. Mr. Nasmyth, in illustration of this important action, adduced the familiar case of the wrinkling of the surface of an apple, by reason of the contraction of the interior and the inability of the *surface* to accommodate itself to the change otherwise. The mountain ranges in question Mr. Nasmyth considers to be nothing more or less than the material which in the original expanded globes formed the comparatively level crust of the Moon and Earth. The fall of the unsupported crust on the retreating nucleus resulting in a tremendous splash on the subjacent molten mass was described to yield a very probable explanation of the appearance of granitic and igneous centres of certain mountain ranges, as well as the injection of igneous rocks, in the form of trap dykes and basaltic formations, which appear to have come forth in this manner from below the crust of the Earth, and overlay formations of comparatively very recent formation. The origin or cause of those bright lines which radiate from certain volcanic centres of the Moon's surface (Tycho, for instance) is alluded to, and illustrated by a very striking experiment, of causing the surface of a globe of glass filled with water to collapse on the fluid interior by rapidly contracting the surface while the water had no means of escape. The result was the splitting or cracking up of the surface of the globe in a multitude of radiating cracks, which bear the most remarkable similarity to those on the Moon. Mr. Nasmyth further illustrated this subject by reference to the manner in which the surface of a frozen pond may be made to crack by pressure from underneath,—so yielding radiating cracks from the centre of convergence, the chief discharge of water will take place, while simultaneously all along the lines of radiating cracks the water will make its appearance :—thus explaining how it is that the molten material, which had in like manner been under the surface of the Moon during that period of its history, came forth simultaneously up through the course of the cracks, and appeared on the surface as basaltic or igneous overflow, irrespective of surface inequalities.—*Proceedings of British Association.*

ON THE AIR AND WATER OF TOWNS.

(From a paper on this subject, by Dr. R. A. Smith, read at the British Association—Edinburgh Meeting.)

It is a matter of great importance to find from what source it is best to obtain water for large towns, and how it is to be collected. Regarding the conditions of many springs, which never become muddy, but possess a constant brilliancy and a very equal temperature at all seasons of the year, the author thinks that there is a purifying and cooling action going on beneath. The surface water from the same place, even if filtered, has not the same brilliancy; it has not the same freedom from organic matter, neither is it equally charged with carbonic acid or oxygen gas,—there are other influences therefore at work. The rain which falls has not the purity, although it comes directly from the clouds; it may even be wanting in cleanness, as is often the case. Springs rise through a great extent of soil, and collect a considerable amount of organic salts; and it is shown by Dr. Smith that their purity is due entirely to the power of the soil to separate all organic matter, and at the same time to compel the mixture of carbonic acid and oxygen. The amount of organic matter removed in this way is surprising, and it is a most important and valuable property of the soil. The change even takes place close to cesspools and sewers; at a very short distance from the most offensive organic matter there may be found water having little or none in it. As an agent for purifying towns, this oxidation of organic matter is the most extraordinary, and we find the soil of towns which have been inhabited for centuries still possessing this remarkable power. St. Paul's Churchyard may be looked upon as one of the oldest parts of London, and the water from the wells around it is remarkably pure, and the drainage of the soil is such that there is very little of any salts of nitric acid in it. If the soil, says Dr. Smith, has such a power to decompose by oxidation, we want to know how it gets so much of its oxygen. We must, however, look to the air as the only source, and see how it can come from it. When water becomes deprived of oxygen, it very soon takes it up again,—as may be proved by experiment. This shows us that as fast as the oxygen is consumed by the organic matter, it receives a fresh portion, conveyed to it by the porous soil. Several experiments of the following character were given, to show the filtering power of the soil. A solution of peaty matter was made in ammonia; the solution was very dark, so that some colour was perceived through a film of only the twentieth of an inch in thickness. This was filtered through sand, and came out perfectly clear and colourless. Organic matter dissolved in oil of vitriol was separated from it by a thickness of stratum of only four inches. A bottle of porter was by the same process deprived of nearly all its colour. The material of which this filter is made is of little importance. One of the

best, according to Dr. Smith, as far as clearing the water is concerned, being of steel filings,—oxide of iron, oxide of manganese, and powdered bricks all answering equally well. This shows that the separation of the organic matter is due to some peculiar attraction of the surfaces of the porous mass presented to the fluid

ON THE SUBSTITUTION OF FLAX FOR COTTON IN THE MANUFACTURE OF CLOTH. BY G. R. PORTER, ESQ.

The fear of being dependent upon foreign countries for the supply of any article of first necessity has often influenced the mind of the public, although the cases can be but very few in which that fear can have any just foundation. It must be evident, upon the slightest reflection, that if the industry and capital of any country have been applied to the production of any article, the market for which is habitually found in some other country, it must be at least as disastrous for the producing country to be deprived of its market as it could possibly be for the consuming country to have its supplies cut off. In point of fact, both countries would necessarily be placed by the interruption in the same condition of distress, since, to be in a condition to deal together, both must be producing and both consuming countries. There are circumstances, however, under which it might be unwise for a country to be willingly dependent upon another for the means of setting its industry in motion, viz., when the causes of the interruption that will operate injuriously are beyond the control of the country of supply; and such a case actually exists in respect of the, to us, all-important article—cotton. Our supply of cotton has hitherto been drawn in very fluctuating proportions from British India, Brazil, Egypt, our West India Colonies, and the United States of America. From this last-named country the quantities were for a long series of years in a continual condition of increase. From Brazil our importations have sensibly lessened without any reasonable prospect of future increase. From Egypt the quantities fluctuate violently, and depend greatly upon causes not falling within ordinary commercial considerations. In the British West Indies the cultivation of cotton has for some time ceased to form a regular branch of industry, and it is hardly to be expected that having thus ceased to be profitable when prices in Europe were uniformly at a higher level than they have been for now a long series of years, the cultivation of cotton to any important extent will be resumed in these colonies. From British India the quantities received depend upon a different set of circumstances, but of such a nature as to forbid any very sanguine hope of great and permanent increase in the shipments. To those who reflect seriously upon these facts, it must appear a matter of grave importance how any continued failure of cotton crops is to be met; and not only so, but also, how a substitute is to be found for the hitherto constantly increasing amount of those crops; for it will not be enough to provide the same amount of employment as before for our continually growing numbers in a branch of industry which, by its ordinary operations, necessarily brings forward those increased numbers. The uneasiness which it is natural to feel under the circumstances here described, has led to the inquiry, as diligently and as carefully as opportunity has allowed, whether some substitute or auxiliary may not be called into action which shall meet the evil that threatens us; and this, it is suggested, may be found in a kindred branch of manufacture—that of flax. A very few years ago, when first anxiety began to arise concerning the prospects of our cotton manufacture, the resource which has just been named did not present itself. At that time, our linen manufacture had not made the progress by which it is at present marked —a progress proportionally equal to any that has been made at any time in the cotton manufacture. Hitherto we have, in this kingdom, been greatly dependent upon our foreign importations for supplies of flax; and while the law imposed restrictions upon the importation of grain for human food, there existed a kind of moral impediment in the way of increasing our home growth of articles for any purpose not of equal primary necessity. That impediment is now removed; and there can be no reason given why our fields should not be henceforth usen for the production of any article that prod mises an adequate profit to the farmer. I- is especially desirable so to apply the prot ductive power of the soil for the suppl- of articles as indispensable to the suppory of millions of people as corn itself; and an additional inducement to the growth of flax beyond that offered by other articles, may be found in the fact, that to bring it to the same condition as that in which it is usually imported from foreign countries, calls for the employment of a considerable amount of human labour. There is no part of the United Kingdom in which the flax plant cannot successfully be cultivated; and there is hardly any country where it might not be brought to supply our deficiencies, should such arise. It should not in any degree interfere with the prosperity of the present race of cotton manufacturers if flax were to be substituted in part for the material now employed by them. Some changes are doubtless necessary in order to adapt their

present machinery for the spinning of flax, but not to any important extent; and the expense to which the proprietors might thus be subjected would be well compensated during the first year of short supply of cotton that might arise, by the security that they would feel in the future regularity of their operations; assured as they then would be against the irregularity of seasons, or those disturbances which have arisen, and which always may arise, to disarrange their operations and to interfere with the regular employment of their hands. It would not appear difficult so to order the arrangements of a spinning-wheel or a weaving shed that both flax and cotton might be included within its operations, and that the preponderance in those operations might be given from time to time either to the one or to the other, according to the capabilities of the markets of supply on the one hand, and the requirements of the markets of consumption on the other.—*Athenæum Report of Proceedings of British Association.*

THE SUBMARINE ELECTRIC TELEGRAPH.

Mr. J. J. Lake, of the Ordnance-office, Plymouth, proposes (*Mining Journal*, November 20), in order to prevent injury to the telegraph wires, from the nature of the bottom, to suspend them by corks, placed at intervals, and to secure them to the bottom by anchors, or a dead weight, at certain greater distances. "By this means," he says "the distance from the bottom could be regulated at pleasure. The suspension of the wires would render them more easy of access; for at each anchor, or weight, a small buoy, with a flag, could be secured, which would indicate exactly their locality; and, in the event of accident, they could readily be found. Had this plan been adopted, the injury to the wires off Cape Grinez could not have occurred, as no part of the wire would have touched the bottom. Very little inconvenience and injury would also result to fishermen and mariners; for the line of flags, or beacons, would point out the neighbourhood of the wires, and but a comparatively small space of ground would have to be left untouched by them."

CASE OF INFRINGEMENT OF REGISTERED DESIGN.

GUILDHALL.—1st October, 1850.

Before Mr. ALDERMAN WILSON.

John Bessel appeared in answer to an information charging him with infringement of a registered design for a newly-invented ventilator, registered in the name and on behalf of William Dixon, of Liverpool, Jan. 7, 1849.

Mr. HINDMARCH appeared, instructed by Mr. Jerwood, for the Plaintiff. The Defendant conducted his own defence.

Mr. HINDMARCH briefly stated that the present information was prepared according to the statute 6th and 7th of Victoria, c. 65, and charged the Defendant with pirating a new and original design for an article of utility, by making a ventilator, and also by selling the same after due notice had been given to him to refrain from so doing, as it was a registered article. The registered design was constructed to fit into a window, instead of an ordinary pane of glass, and so contrived that by pulling a cord on one side the ventilator was put into action so as to be opened, and another on the other side closed it again. That Defendant's ventilator was made in the same way, but had a metal instead of a wooden frame, and the principal screw on which the ventilator acted was curved to allow the pane to open on a hinge, instead of a straight screw, with a joint near the pane, to which it was attached, as was the case with Complainant's article.

Witnesses on the part of the Complainant appeared, and proved that they had seen ventilators in the course of manufacture in Defendant's premises, and that he had sold them after notice had been served upon him prohibiting him from making or selling, such being a piracy of the registered design.

The certificate of registry was put in belonging to the Complainant, when it was found that Defendant had not manufactured his article within nearly two years after Complainant had his.

Alderman WILSON said, that a more barefaced piracy he had never seen. It was a very clever invention, and he thought Mr. Dixon ought to have had at least seven years' protection, instead of the three years granted by the Act, to recompense him for his ingenuity. It was quite clear that Defendant had been guilty of both making and selling the article alleged to be a piracy on Mr. Dixon's design, and he should therefore inflict a fine of 30*l.* for each offence, and order him to pay 10*l.* expenses.

Mr. HINDMARCH offered the Defendant a mitigation of the penalties if he would undertake to discontinue the piracy.

The Defendant said he would take the opinion of counsel upon the subject, but he could not promise to refrain from continuing the manufacture of the registered design claimed by Mr. Dixon. And that he could not afford to pay 70*l.*, as his circumstances would not allow him to raise such a large amount.

It was afterwards arranged between the parties that the Defendant should have time to pay the fine and expenses.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING OCTOBER 3RD, 1850.

THOMAS DICKASON ROTCH, of Drumlamford House, Ayr, North Britain, Esq. *For improvements in separating various matters usually found combined in certain saccharine, saline, and ligneous substances.* (A communication.) Patent dated March 26, 1850.

The first three of the improvements embraced in the present specification have special reference to the centrifugal acting machines which have of late years been so extensively employed for drying purposes, and more recently in the purification of sugar. (See notices of former patents; of Seyrig's, which was the first, vol. 39, p. 237—Keely and Alliott's, vol. 44, p. 420, and Finzel's, vol. 52, p. 319.)

1. Mr. Rotch's first improvement has for its object to prevent or counteract the oscillation of the drum on its axis when in rapid motion, and consists in the application of a hanging weight suspended from the socket of the vertical shaft—such socket having a hemispherical flange or other contrivance for allowing motion in the nature of a universal joint.

2. Or, the tendency to oscillate may, it is stated, be got rid of altogether, and the consequent loss of power by friction avoided by stepping the vertical axis within a circle of conical friction rollers bearing up against it.

3. When such machines are employed in the purification of sugar, it is usual to inject a portion of syrup in order to assist the discharging process. Mr. Rotch proposes to use for this purpose syrup, which has been previously supplied from the vacuum pan into large coolers, and consequently in large crystals, of the density of 30° to 35° Beaumé, and at a temperature of 120° to 125° Fahrenheit. Syrup of this quality is stated to act more effectually than any other.

4. For the purpose of refining sugar, Mr. Rotch suggests the application of woollen, linen, or cotton fabrics, along with sponge, or some other suitable spongy material. The sugar, while in moulds, is to be twice liquored with a solution composed of two quarts of syrup, of the density of 34° Beaumé, and half that quantity of distilled water; a piece of cloth is then to be laid on the top of the mould, and on the cloth a sponge of 1¼ or 2 inches thickness. The cloth and sponge are to be saturated and re-saturated with filtered water, decreasing the quantity at each successive wetting during two days; at the end of which time the sugar will, it is said, be perfectly decolorized, refined, and whitened.

5. Mr. Rotch claims, finally, the "exclusive right and privilege" to the application of centrifugal machines to the treatment of saline substances. The salt to be operated on is placed in the drum, and moistened with pure, fresh, or salt water. The action of the machine expels the water and other impurities, and the salt is left, in a refined and almost dry state, adhering to the sides of the drum.

JAMES PREECE, of Hereford, shoemaker. *For certain improvements in mills and machinery applicable to the threshing and grinding of corn, the manufacture of cider, and other similar purposes.* Patent dated March 26, 1850.

The improvements described by Mr. Preece, and to which he lays exclusive claim, are

1. An arrangement whereby the main driving shaft of water-mills can be detached from the water-power wheel-gearing, and driven by manual power; or by which, in the event of the supply of water, as frequently happens in dry seasons, not being sufficient of itself to drive the mill, manual power may be made use of as an auxiliary to compensate for the deficiency of water power. For this purpose the shaft is fitted with a boss and stud-holes for the insertion of levers, by which the shaft is turned in manner similar to working a capstan.

2. The employment of an extra driving wheel in thrashing machines, and cyder presses, and other hand machines, or mills of a similar description.

3. The employment of two or more driving wheels and handles in hand-mills or machines, whereby several persons can simultaneously work or turn such machines. And,

4. The employment of fast and loose pulleys, and belts or bands, for driving such machines from a suitable prime mover, instead of handles for actuating them by manual labour.

EVAN LEIGH, of Miles Platting, near Manchester, cotton spinner. *For certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances.* Patent dated March 26, 1850.

The improvements claimed under the present specification are as follows:

1. In carding machines—the employment of an endless travelling sheet of cards or "flats," the dents or cards of which are

set in transverse strips with intermediate spaces—travelling flat cards under the main carding cylinder, whether applied to the upper or under side of such cylinder—and a fancy roller for stripping the main cylinder, having only a portion of the surface of the cloth with cards thereon.

2. In lap tables—the employment of a tapering table furnished with a guide and callender roller, whereby the ends or slivers are taken from the cams and delivered in a right line, side by side, to the lapping machine.

3. In slubbing and roving frames—the employment of a revolving bolster and step —an arrangement for dispensing with the cone commonly used in such machines, which consists in driving the bobbins at an uniform speed through the set, and causing the bobbins to act as such in filling—and also driving the spindles of slubbing and roving frames by means of a zig-zag strap or band.

4. A method of driving the spindles of those machines in which spindles are employed, by means of the edge of flat belts or bands.

5. The employment of paper or other flexible tubes in place of bobbins, such tubes being of greater length than the lift of the copping rail.

6. The application of a tapering motion to throstles, whereby both ends of the cop may be formed bevilled, or inclined alike, and all the complicated machinery hitherto employed in forming a cop upon throstles similar to a mule cop dispensed with. And

7. The employment of cast iron instead of steel in forming spindles, as being less costly and more durable material.

Joseph Theodore Clenchard, of Paris, manufacturing chemist. *For certain improvements in the application of orchil to the processes of dyeing and printing in colours, and also an improved apparatus to be employed in the operation of dyeing.* Patent dated March 26, 1850.

1. The orchil, or lichen in its natural or imported state, is proposed to be used and applied in combination with alkalies and lime to the direct dyeing of wood and silk, and wool, and silken fabrics. This operation is performed by mixing together 40 to 50 gallons water, and 40 to 50 lbs. quick lime recently slacked; the mixture is allowed to settle, and the clean liquor, after being decanted, is boiled with five to seven ounces good clean soda ash, and 180 to 220 lbs. (in proportion to the depth of colour required) orchil, previously ground. The cloth to be operated on may either be boiled now, or after boiling the orchil till a sufficient quantity of colouring is extracted, and the dyewater may be poured off and used as required, On removing the cloth from the dyeing boiler it is to be immersed in a solution composed of dyewater and caustic ammonia, the quantity of which should be equal to about 20 per cent. of the orchil used in making the decoction.

Mr. Clenchard specifies also the application of orchil in its natural or unprepared state in combination with alkalies, and with or without lime to the printing of woollen fabrics. For this purpose the liquor, composed as above described, is reduced by evaporation to about one-fourth the original quantity, and then applied as customary in printing cloth; but in cases where lime would act injuriously on the material to be printed, it may be dispensed with in making the dye liquor.

3. An improved apparatus for dyeing is next described. This apparatus consists mainly of an octagonal trough with moveable lids. Lengthwise of the trough runs a perforated cylinder supporting a frame-work, on which are arranged the pieces of material to be dyed. The cylinder is fitted at one end with a cog-wheel connected with driving machinery, and one arm of the cog-wheel works a force-pump, through which dye is supplied to the cylinder, and by its rotation to the cloth on the frame. For the admission of air the cylinder has an arm attached to it, which at each revolution strikes against and tilts the cover. The dye as it drips from the cloth falls into a receiver under the trough, whence it is again raised by a force-pump and injected into the cylinder.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman. *For improvements in coupling joints for pipes.* (Being a communication.) Patent dated March 26, 1850.

Claim.—"The constructing of coupling joints by enveloping the abutting ends of pipes (grooves being cut thereon), in a belt or tube of lead, or other suitable yielding substance, so as to cover the seam or junction, and then forcing over this belt or tube, a tube of some harder or unyielding substance (cast-iron for instance), whereby the yielding substance will be compressed between the pipe and the outer tube, and a secure joint will be obtained."

Thomas Walker, of Wednesbury, Stafford, iron master. *For improvements in the manufacture of sheets or plates of iron for certain purposes.* Patent dated March 28, 1850.

The patentee describes; first, an arrangement of apparatus for rolling iron in opposite directions, and then, by means of circular saws so arranged as to traverse backwards and forwards, cutting the ends of plates so formed, and while hot; the

plates being held firmly fixed during the cutting operation on a fixed bed-plate.

Claim 1. "I do not claim as of my invention or the exclusive use of the arrangement for rolling iron in opposite directions, and for cutting bridge or boiler plates, except when the same are employed for the purposes of my invention, which I declare to consist in the manufacture of sheets or plates of iron, such as bridge and boiler plates, by causing the metal to be passed in opposite directions through the rolls, and then to be cut by circular saws at the edges when hot as it leaves the rolls."

A second improvement included in this patent consists in the manufacture of plates of varying width, such as links for suspension bridges, &c. Hitherto plates of this sort have been formed by welding on pieces where required; an operation wherein the texture of the iron is injured in consequence of the repeated heating and hammering. Now, to obviate this disadvantage, Mr. Walker proposes to form a fagot of greater thickness in those parts where additional width is required, which will, on being rolled, assume the requisite shape, and can then be finished at the edges in the ordinary way.

Claim 2. "The manufacture of plates or sheets of iron of varying widths by fagoting and forging, and by rolling the metal at one heat."

George Attwood, of Birmingham, copper-roller manufacturer. *For a new or improved method of making tubing of copper or alloys of copper.* Patent dated April 15, 1850.

This "new and improved method" consists in employing for the manufacture of tubing old worn out, done with, or no longer wanted rollers, such as are employed in printing cloth, and for other similar purposes, and which, although sometimes composed wholly of copper, and sometimes of alloys of that metal, are all nevertheless, in Lancashire and other places where they are made and used, technically called "Copper rollers." For this purpose they are, first, when necessary, bored out true, and then either rolled between suitably grooved rollers or elongated in drawn benches on steel or iron mandrils, to the required bore and thinness of metal; being annealed during either of these operations as often as requisite.

Claim.—The manufacture of tubing of copper or alloys of copper from "Copper rollers," as aforesaid; and also the exclusive use of such old worn out, done with, or no longer wanted "Copper rollers" for the purpose of being elongated, drawn out, and contracted into tubing.

John Sheafe Gaskin, jun., of the Island of Barbadoes, gentleman. *For improvements in the manufacture of rum.* (To extend to the Colonies only.) Patent dated July 31, 1850.

The patentee observes that the manufacture of rum is at present, and has been hitherto, conducted in a most slovenly manner; no regard being paid either to the quantity of saccharine contained in the "sweet water," skimmings and molasses used, or to the due proportions of each in mixing;—to the cleanliness of the vats, pipes, and vessels employed—to due ventilation of the building, or to the method of conducting fermentation; in consequence of which circumstances, and the length of time occupied in the last process, generally from ten to fourteen days, owing to an excess of saccharine matter, part of the liquor fermented passes from the vinous to the acetous state, the "dunder," or residue, contains a quantity of saccharine, and the spirit produced is necessarily of inferior quality.

Now, it is proposed to keep all vessels, pipes, &c., clean, by using water and lime to remove and prevent acidity—to limewash the exterior of such vessels and the interior of the building—by due ventilation to keep the building as cool as possible—and to clarify by boiling, the "sweet water," skimming, &c., before mixing. The process of clarification is thus conducted. The "sweet water," &c., is received in suitable iron or copper vessels, and heated to about 212° Fahr., after which the source of heat is removed, the liquor allowed to cool for about half an hour, when sufficient cream of lime is added to remove all traces of acidity, which may be tested by litmus paper. The clear liquor is now to be drawn off and mixed with molasses, till it acquires a specific gravity of 1050 to 1054 (taking the specific gravity of water to be 1000). When the heat is about 80° Fahr., the process of fermentation may be allowed to commence, and during this process the heat gradually rises to 95°, and even 96°, but should it rise to 100°, it is evident that the specific gravity of the liquor is rather too great. The process may be considered a "healthy" one, if attenuation takes place at the rate of about 1° during each of the first twelve hours, and to a greater extent afterwards, so as to complete the fermentation in about three days; in which case, if the process be properly conducted, the "dunder" or residue will be of no value; but should the "dunder" still contain any saccharine, it may be again fermented, but on no account mixed with fresh liquor.

As soon as fermentation is completed, the wash is taken to the still—the first receiver of which should contain about 30 gallons of

low wine, one-eighth of a gallon of common salt to each gallon of wine, and about two gallons of freshly-expressed cane-juice. The second receiver should contain a quantity of fresh spring or rain-water equal to the low wine in the first. The first gallon of rum that comes over is to be emptied into the low wines butt. Over each receiver a wicker basket is placed, and filled with vegetable charcoal, through which the rum is allowed to filter; which is considered to be of advantage.

The spirit produced by the above process of manufacturing is stated to be of better quality, and more, in proportion to the quantity of saccharine employed, than that obtained by the methods now ordinarily in use.

The patentee does not confine himself to the precise details above given, so long as the peculiar character of his invention is retained. No claims.

RECENT AMERICAN PATENTS.

(Selected and abridged from the *Franklin Journal.*)

COMPOSITION FOR ENAMELLING HOLLOW WARE. *Messrs. Parie.*

This composition consists of 130 parts of flint glass reduced to powder, 20½ parts of carbonate of soda, and 12 parts of boracic acid. These matters, being intimately mixed, are to be placed in a glass-maker's crucible and melted; the same are then to be drawn off and cooled, and then broken down into fine powder.

STEAM BOILER FURNACES. *B. Crawford.*

The patentee claims the injection of whirling jets of highly heated steam among the gases evolved by the fuel on the grate, simultaneously with the forcing, by a steam blower, of a stream of mingled steam and heated air through the ash-pit into the fire, the air being heated by the exhaust steam and waste heat of the flues, and the draught of the flues being maintained by whirling jets of steam injected by the steam blower.

ILLUMINATING GAS FROM BITUMEN. *A. Gesner.*

This invention is stated to consist in having obtained from compact and fluid bitumen, asphaltum, chapapote, and mineral pitch, a new illuminating gas, which the inventor denominates "Kerosene Gas." This gas differs from all other illuminating gases, for as the bitumen contains no sulphur or nitrogen, it is free from sulphuretted hydrogen, sulphurous acid, sulpho cyanogen, cyanogen, ammoniacal gas, and azote, and its relative quantities of carbon and hydrogen differ from those of the gases heretofore used for the purposes of illumination.

EXCAVATING AUGER. *J. Buck.*

This is a machine or instrument for boring the earth under water or otherwise, and retaining the substance bored until it can be brought to the surface. It is constructed in the following manner:—"I first make two sections of a cylinder, or pods, the one of which is enough smaller than the other to admit its turning into the larger one, and I connect them together by pivots through the ends of each, the larger section of a cylinder or pod, having a lip similar to a pod auger, and I attach a shaft or handle firmly to the upper pivot, which pivot passes through the centre of the outer section of a cylinder or pod, and is attached firmly to the smaller section of a cylinder or pod, so that by turning the shaft one way, I put it into a pod auger shape ready for boring; by reversing the motion of the handle or shaft, it turns the inner section of a cylinder out of the other, making it into a cylindrical or bucket shape, and thereby secures the substance bored."

AIR-HEATING FURNACES. *H. A. Engles.*

A pair of concentric cylinders are to be so placed over a furnace, that the flue can be made to pass spirally between the cylinders, thus making the inside face of the inner cylinder and the outside face of the outside cylinder radiating surfaces; and, in addition to this, the base of a cone-shaped drum or chamber is to be attached to, and inside, the lower end of the inner concentric cylinder (or in any other suitable way), so as to obtain a radiating surface from the outside of the drum, which is thus made to form the roof of the furnace; the whole fixtures thus being made to furnish the most extensive radiating surface "within the smallest possible compass." This arrangement also enables "a small air chamber to furnish a comparatively large amount of heated air." Another feature of this invention is the combination with the furnace of what is called a steam-infuser, "whereby the heated air in the chamber surrounding the furnace is supplied with an adequate degree of moisture, so arranged as to be regulated at pleasure," "thus obviating the unhealthy and disagreeable effects due to air which, in the process of being heated, is rendered too dry for being breathed, and, therefore, unfit for domestic or other apartments."

ELECTRIC TELEGRAPHS. *W. S. Thomas.*

Claim.—What I claim as new is the making of signals or marks for telegraphic purposes by the agency of heat generated, induced, or controlled by a current of electricity passed along attenuated conductors, wires, or points; the signals being the flashes of light emitted by the heated con-

ductor or points, are manifest to the eye of the operator; the marks being produced on the paper by the heated points or conductor, are the record of the message.

GIVING A ROTARY MOTION TO METAL IN CASTING CHILLED ROLLS. *J. C. Parry.*

This invention consists in the insertion into the mould in which a roller is cast of a small cylinder of iron or other metal, of a peculiar shape, which is attached to a rod, and placed in such a position inside of the mould, and fronting the mouth of the gate through which the melted metal enters the mould, that the melted metal, after leaving the gate, and when it has entered the mould is diverted from the straight direction with which it entered, and prevented by the position of the small cylinder with a wing attached to it (called a wing-dam), from running otherwise in the mould than in a circular direction around its circumference, whereby it receives a strong circular motion, which continues until the process of casting is finished.

FIRING KILNS FOR POTTERY WARE, BLACK-LEAD CRUCIBLES, &c. *J. Dixon.*

This invention consists in substituting resin for the kinds of fuel heretofore used for these purposes, the distillation of which readily, and at a low temperature, it is said, evolves a great quantity of highly inflammable gas, which, in an inflammable or inflamed state, extends through all the parts of the kiln, giving an equal, or nearly equal, heat throughout, that will bake equally, while at the same time it contains more carbon than the supporter of combustion can take up in passing through the flues of the kiln formed by the ware, and thus prevents the injurious action of the heated oxygen on the surface of the ware, particularly when baking black-lead crucibles.

STEAMING GRAIN PREPARATORY TO GRINDING. *Israel Jackson.*

The patentee says, "The nature of my improvements consists in causing the grain as it passes from the shoe of the hopper to the eye of the millstone, to traverse for a short space a highly heated current of steam, whereby the skin of the grain is at once softened and toughened without disturbing the texture of the body of the kernel. The consequence of this sudden superficial scalding is, that as the grain passes immediately between the mill-stones, the hull is at once rubbed by the stones clear from the body of the kernel; the bran remains in large flakes and is easily sifted out, the flour is completely detached from the bran, and the yield in true flour is materially increased."

Claim.—"I claim, in combination with a steam pipe and grain passage, the deflecting partition for directing the steam upward and the grain downward, whereby the current of grain is steamed by direct contact with the current of steam at the moment before entering the mill, substantially as herein set forth."

ELECTRO - CHEMICAL TELEGRAPHS. *Westbrook and Rogers.*

The nature of this invention is stated to consist in recording telegraphic signs on a metallic surface, connected with the earth by a wire conductor at one end, and to a galvanic battery and the earth at the other end of the circuit, by the use of acidulated water or other fluid interposed between the point of the usual wire conductor leading from the operating apparatus connected with a galvanic battery of the ordinary construction, and the metallic surface, by which the use of paper is dispensed with; time also being saved in not having to moisten the chemically prepared paper when it becomes too dry for use, and in having the telegraphic signs more clear and distinct on the metallic surface than on the paper; and in avoiding the inconvenience arising from the fumes from the chemicals employed in preparing the paper, and evils arising from the corrosion of instruments, and in annoyance to the operators in preparing and using chemical paper and other inconveniences.

Claim.—What we claim is recording telegraphic signs on the surface of a revolving metallic cylinder plate, or other equivalent surface by means of an acidulated liquid or saline solution, or water held between the point of the wire conductor and the metallic recording surface, by means of a non-conducting porous substance contained in a glass, or other non-conducting reservoir, in which the recording fluid is contained, to which the electric current from a battery is applied by means of any of the known forms of manipulators and anvils used for making and breaking the circuit—the recording fluid being applied to the metallic recording surface substantially in the manner herein fully set forth by which the use of every description of paper is dispensed with, thereby saving a great expense in telegraphing.

METHOD OF FORMING EMBANKMENTS. *Duff Green.*

The patentee says, "My invention consists in conveying the earth from the site whence it is to be removed to the place where it is to be deposited, by means of a current of water caused to flow artificially in a trough or trench from the one place to the other with sufficient velocity to carry along with it the earth thrown therein, but which, when it arrives at the place of deposit, has its velocity sufficiently checked to be

no longer capable of carrying along the earth which is therefore deposited.

Claim.—The method herein described of depositing earth to form embankments, levees, &c., and to fill up low situations, by means of filtering dams or other equivalents, and a trough or other conduit conveying earth and water from a higher level, substantially as specified.

WEEKLY LIST OF NEW ENGLISH PATENTS.

James Hamilton, of London, engineer, for improvements in machinery for sawing, boring, and shaping wood. September 28; six months.

Charles Harratt, of Royal Exchange-buildings, London, merchant, for improvements in rolling iron. September 28; six months.

Joseph Burch, of Craig Works, Chester, printer, for improvements in printing terry and pile carpets, woollen, silk, and other materials. September 28; six months.

Joseph Crossley, of Halifax, carpet manufacturer; George Collier, of the same place, mechanic; and James Hudson, of Littleborough, printer, for improvements in printing yarns for, and in weaving carpets and other fabrics. September 28; six months.

Cyprien Theodore Tissereau, of Paris, France, gentleman, for certain improvements in hydraulic clocks. October 3; six months'

Jean Pierre Paul Amberger, of Paris, France, civil engineer, for certain improvements in the application of magnetic power for moving and stopping carriages, for giving adherence to wheels upon rails, and also for transmitting motion. October 3; six months.

William Tudor Mabley, of Manchester, patent agent, for certain improvements in the manufacture of soap. (Being a communication.) October 3; six months.

William Boggett, of St. Martin's-lane, Middlesex, gentleman, and William Smith, of Margaret-street, in the said county, engineer, for improvements in producing and applying heat, and in engines to be worked by steam or other elastic fluid, which engines are also applicable as pumps. October 3; six months.

Julian Bernard, of Buchanan-street, Glasgow, artist, for improvements in pneumatic springs, buffers, pumps, and stuffing-boxes. October 3; six months.

LIST OF IRISH PATENTS FROM 21ST AUGUST TO THE 19TH SEPTEMBER, 1850.

George Gwynne, of Sussex-square, Middlesex, engineer, for improvements in the manufacture of sugar. August 24.

Robert Reid, of Glasgow, Lanark, manufacturer, for certain improvements in weaving. August 27.

Richard Archibald Brooman, of the firm of Messrs. Robertson and Co., 166, Fleet-street, London, patent agents, for improvements in types, stereotype plates, and other figured surfaces for printing from. September 6.

James Rennie, Gowan Bank, Falkirk, Stirling, North Britain, gent., for certain improvement or improvements in the construction of gas retorts and furnaces, and in apparatus, or machinery applicable to the same. September 10.

Peter Fairbairn, of Leeds, York, machinist, and John Hetherington, of Manchester, for certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton, flax, and other fibrous substances; also, in constructing and applying models of patterns for moulding, preparatory to casting parts of machinery employed in preparing, spinning, and manufacturing fibrous substances; and also in certain tools to be used in making such machinery. September 13.

George Thompson, of Park-road, Regent's park, Middlesex, gent., for certain improvements in machinery and apparatus for cutting, digging, or turning up earth, applicable to agricultural purposes. September 14.

George Attwood, of Birmingham, for a new or improved method or making tubing of copper, or alloys of copper. September 18.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Sept. 26	2454	Joseph Morris and Sons,	Astwood, Redditch	Needle-case.
28	2455	Hurst and Reynolds	Birmingham	Improved fastening for stays, and other articles of dress.

CONTENTS OF THIS NUMBER.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1418.] SATURDAY, OCTOBER 12, 1850. [Price 3d., Stamped, 4d.
Edited by J. C. Robertson, 166, Fleet-street.

HUBBELL'S SOLAR MAGNETIC ENGINE.

Fig. 1.

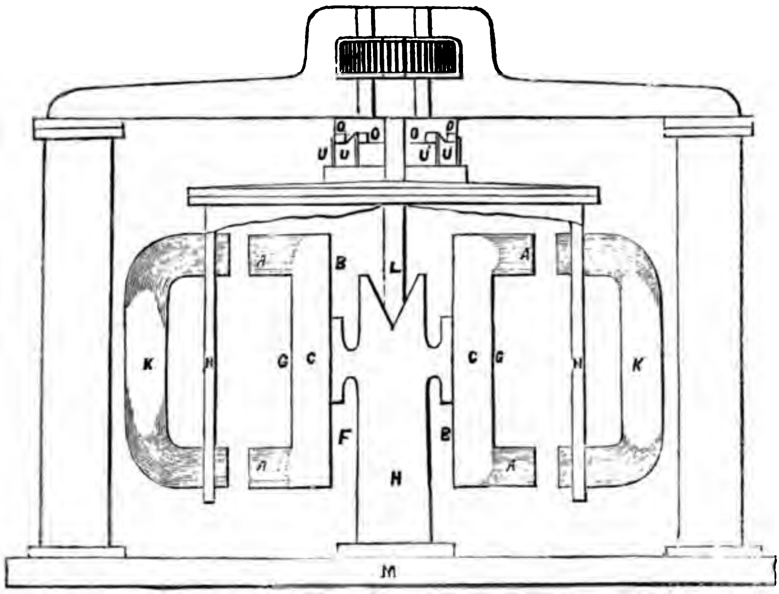
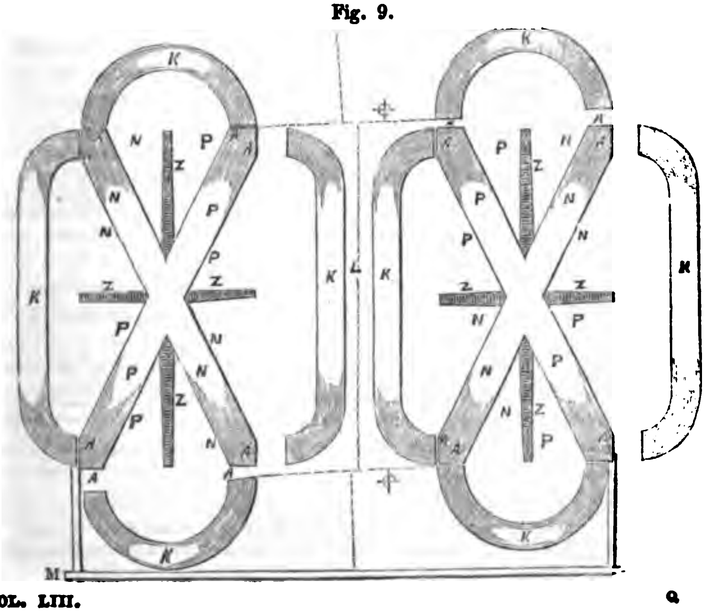


Fig. 9.



DESCRIPTION OF THE SOLAR MAGNETIC ENGINE INVENTED BY W. W. HUBBELL, ESQ., OF PHILADELPHIA. BY THE INVENTOR.

MAGNETISM I believe to be a fluid which pervades all material things, though in different degrees, and that it will pervade soft iron and steel to the greatest degree. It has two qualities within its nature—a positive and a negative; which in different bodies attract each other, while each seeks to diverge from its kind in different bodies by repulsion. Positive magnetism, or that of the North Pole, results from the zinc portion of a galvanic battery; and negative magnetism, or that of the South Pole, results from the copper or iron portion of a galvanic battery. The production of magnetism by a galvanic battery, called electro-magnetism, is common, and the method well known at the present day.

In order to enable others skilled in the art to make and use my solar engine, I will proceed to describe its construction and operation, reference being had to the annexed engravings, making, together with the written descriptions thereon, accompanying figs. 3, 4, 5, and 6, a part of this specification, and on which like letters refer to like parts hereafter explained.

The principle or character of my invention is based upon principles which I have deemed as a guide in developing my invention, to exist in the solar system of the universe; and being intended by me, so far as may be necessary to obtain an organized mechanical power and motion, as an imitation of the solar system, I have thought proper, for elucidative purposes, to designate my invention the "Solar Magnetic Engine." Its nature is based in imitation as follows:—I suppose the sun or centre of the system to be possessed of the magnetic principles of attraction and repulsion, and exercising these influences at every point of an unbroken circumference around a common centre or axis; its face possessing equal capacity of power at any circumferential, with any other parallel circumferential point, to attract, direct to, and repel directly from this common axis or centre.

I therefore construct a centre or solar magnet to embody within its own nature these aforesaid principles. This magnet, with the variable modes that have occurred to me of constructing it, are hereinafter described.

To imitate the planets revolving about, and governed by the sun and each other, as far as, for my purpose of attaining available power in machinery is necessary, I have one, two, three, eighteen, or fifty, more or less than two, magnets vested with attractive and repulsive power, and playing about and governed by a common centre not coincident with the centre of the solar magnet, but so fixed near it, that these planetary magnets, by mutual attraction between each of them and the solar magnet, approach from their aphelion or farthest point of recedure, to their perihelion or nearest point of approach to the solar magnetic surface, and then by changing their poles relatively to this surface, when, or as they successively reach the nearest point of approach, they of the planetary and the solar magnet repel each other, until the receding planetary magnets respectively arrive again at their aphelion or point of farthest recedure, where their poles again rechange, and they of the planetary and the solar magnet attract each other, and thus the planetary magnets successively change at their points of aphelion and perihelion, and approach near to, and recede from, and revolve around the solar magnet: which solar magnet, at its very circumferential point, exerts its power on the revolving plaentary magnets; and as within itself, owing to its formation, it concentrates and embodies, to and from its common centre, a great and uniform capacity of attractive and repulsive nature, so also when combined with the planetary magnets, it developes an uniform and continuous power for practical use, as an universally appropriate power.

With regard to the solar magnet, reference being had to figs. 1 and 2, it is constructed as follows: Figs. 1, 3, 4, and 9, are each a sectional view of different solar magnets, on a line extending longitudinally through the centre or diameter of the engine; figs. 1 and 9

also showing some of the planetary magnets. It (the solar magnet) may be said to be as continuously circular horse-shoe magnet, or to consist of two circular plates, AA AA, joined in the centre or at the inner circle BB, by a circular back, column, or cylinder CC, either solid or hollow; or the two circular plates may be joined at the outer or largest circumferential surface (as in fig. 3), by a circular ring, cylinder, or back; or as in fig. 4, the magnet may have both an inner and an outer circumferential surface, DDDD, DDDD,

Fig, 3.

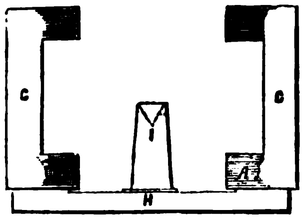


Fig. 4.

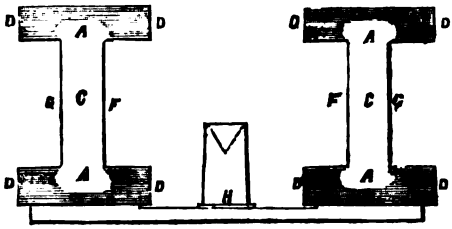


Fig. 5.

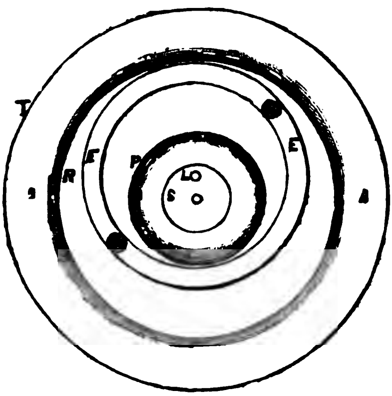


Fig. 6.

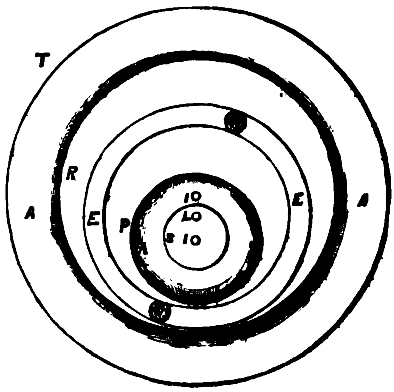


Fig. 2.

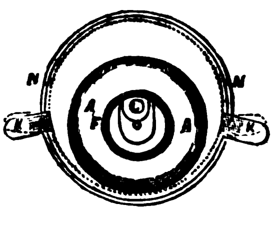


Fig. 8.

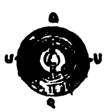
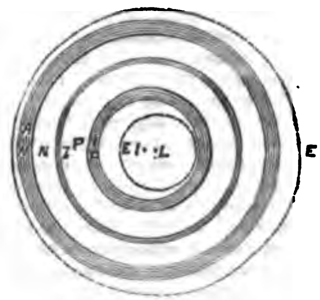


Fig. 7.

Fig. 10.



formed by connecting the two circular plates AA, AA, about midway between these surfaces, by a circular ring, cylinder, or back CC; this magnet will then be a combination of the one in figs. 1 and 2, and the one in fig. 3; or another mode to combine them is to have them separate as first described, yet the one, fig. 3, so small, and the one, figs. 1 and 2, so large,

that the former will set within the circuit of the back of the latter, and thus they, back to back, with or without a wood cylinder, or other non-conducting substance between them, will be effectively combined; or the latter may set within the former, face to face, as in figs. 5 and 6, and the planetary magnets approach and recede as indicated by their respective paths EE and EE; or they may further be combined, as is expressed in figs. 4 and 3 of the engravings. The solar magnet may consist of solid wrought, or cast iron, or steel, or may be made of numerous thin plates of iron or steel (or other suitable metal) riveted, or screwed, or bolted, or otherwise secured together, or it may be made of soft wrought iron or steel strips or wire, having the ends thereof to terminate and form the circumferential or magnetic surfaces of the magnet. The number of pieces of wire in this case must be very great, and each one bent to suit and construct the horse-shoe form of the solar magnet. I deem it best made of plates; and when the solar magnet is made of numerous pieces of thin plate or wire, each piece may be cut or spread of the shape displayed in fig. 7, the dotted lines XX indicating where it is bent to form the poles; of course, in this case the smaller pieces form the inside of the poles, and the outside of the connecting cylinder or back in figs. 1 and 2, and the inside in fig. 3, and each succeeding piece must be as much longer than this as the thickness of the plate requires to make it fit to the former; and also the pieces forming each succeeding layer should be set over the junctures of the pieces forming the preceding layer, as in fig. 8; a coil of the covered wire from the batteries may be put between each layer or between every second or third layer of plate or wire, to more effectually magnetize the said solar magnet. In the solar magnet, one circular end becomes a north pole, and the other one becomes a south pole; and the strongest magnetic power exists around the circumferential surfaces, and acts convergently and divergently to and from the common centre of the circle. This solar magnet may be either a permanent or an electro-magnet; when permanent, it should be of steel and be packed inside at the central part F, and between the poles GG, with loadstone, or it may be of wrought or cast iron, steel, or other material, and magnetized by means of a galvanic battery or batteries, in which case the coils of the covered wire should be wrapped in the space between the poles, both inside and outside of the cylinder or back, and also a coil or coils should be laid on the side of each pole AA, thus and always covering the magnet with coils of covered wire as numerously, as heavily, and at every part, except the circumferential faces, as much as possible; and thereby giving those faces the greatest magnetic power.

And now, as to the construction of the solar engine: I affix the solar magnet to a strong wooden (mahogany, maple, or oak, &c.), or suitable metallic base (H, fig. 1, or H, fig. 3, or H, fig. 4), the point I being the centre of this solar magnet; and around this solar magnet's magnetic surfaces I arrange the planetary magnets (KK, fifty more or less in number, figs. 1 and 2); these are best made of numerous pieces of porous, soft, wrought iron wire, they may be solid, and of the ordinary horse-shoe form, or they may be straight; either ends, heads, or faces towards the solar magnet may present the inverse or converse curve of its faces, or be straight-faced, or rounded; the inverse or converse is the best; the breadth of their faces should be about the same as that of, and directly opposite the faces of, the solar magnet, and each magnet must be separate and distinct from the others; in this way they must be attached to a revolving frame, or cylinder, governed by its own independent centre or shaft L, and this centre be near the solar centre I, as in fig. 2, so that the planetary magnets, as they revolve around the solar magnet, may successively approach as near as possible, without contact, to its faces; and then may recede from its faces to nearly the utmost extent of its influence. The modes of suspending or securing central shafts and bases, thus relatively to each other, are numerous, and well known to machinists. I have in the engraving shown the shaft suspended vertically, as I deem that the best relative construction for the engine, and have rested the planetary shaft on the central column, or base which sustains the solar magnet, and rests on the general engine base M. I have sprung a metallic arch or beam resting on columns, over the engine, and resting on the general base, for the purpose of receiving the upper end of the planetary shaft L, and also to hold the charging keys of the planetary magnets KK *et al.* The appropriative power of the engine can be taken from the upper part of this planetary shaft by cog-wheels, pulley-wheels, or any of the known means.

The beam, columns, and base, whenever the bulk is not material, are best made of wood, such as mahogany, maple, oak, &c,; so also the planetary frame is best made of wood. The engine may also be suspended horizontally, in which case the planetary shaft may rest on an oak or other wooden frame, on each side of the solar magnet; this any mechanic will know how to construct in numerous ways, without directions from me.

The number of engines may also be increased to two, four, or ten, or any other number on the same shaft, the shaft being either vertical or horizontal, and the engines either above

or horizontal to each other, or each engine may rest on its own shaft, and their power be concentrated on a single shaft by means of cog-wheels, pulley-wheels, or any of the known means of communicating power. One excellent method is to set numerous engines immediately under the circumference of a large cog-wheel, with a cog-wheel from the upper part of the shaft of each engine running in gear with it, and thus they all concentrate their power into it. Another is, to set them under a horizontal shaft, and each give its power to it by means of a bevel cog-wheel on the planetary shaft, and another on the horizontal shaft.

Each of the planetary magnets should be secured between two wooden rings, or otherwise to the revolving frame, or series of arms, or cylinder NN, and each of these magnets is wrapped with covered wire to magnetize it from a battery; which wires UUUU, are led to near the planetary shaft L, where they are held in and by slots cut through a wooden ring, and those from the positive poles are in contact with positive semi-circuit keys, and those from the negative poles are in contact with negative semi-circuit keys. It is well known that the positive pole or semi-circuit key can be made negative, and *vice versâ*, by simply changing the wires from the one to the other nature of the battery. These semi-circuits, OO, OO, around the planetary centre are four in number, are stationary with the arch or beam, and form two circuits, each having two breaks, QQ, QQ, the one semi of each being positive, and the other negative: the one break where the poles change is opposite the perihelion or nearest point of approach to, and the other break is opposite the aphelion or point of farthest recedure from the solar magnet. The breaks consist of ivory, or other non-sonducting substance; and as the wires from the planetary magnets, in revolving with their respective magnets, pass from one semi-circuit on to the other, either by platina or other metallic wheels on them, rolling in contact with the circuits, which is the best mode; or by having platina, or other metallic ends, which slide around against the circuits, they respectively cause their respective magnets to change from positive to negative, and *vice versâ*, end for end; and thus the planetary magnets continuously approach the solar magnet by attraction, and recede from it by repulsion, being continually under its influence and revolving around it. It is evident that, in their approach to the solar magnet, they may not be magnetized, as it will attract them; but I deem it best to magnetize them at this time, as well as necessary on their recedure. Copper wire, covered with cotton or other substance of a non-conducting nature, is usually employed to wrap magnets, in order to magnetize them by a galvanic battery. Any suitable covered wire may be employed in this engine, and wherever the charging keys and planetary wires are in a state of friction, platina is the best metal to use, as it will not readily oxidize; this fact is already well known in the art; therefore the semi-circuits of the charging keys (excepting the ivory breaks) are best made of platina, also the ends of the planetary wires, and the little friction wheels that run on them and bear against the keys, are best made of platina.

To charge the planetary magnets as heavily as possible, each pair of opposite magnets should have their own circuits of keys, in which case the circuits may be very small and above each other, and each charged by a separate battery; or, if this is not done, it is best to make as many conducting wire connections, to and at equal distances along the circuit of the charging keys, as there are planetary magnets, in order to distribute the fluid and magnetize them effectively.

The revolution or the motion of the engine may be reversed, by mutually changing the wires of either of the solar or planetary magnets in the battery. This may also be done by a simple lever with sliding conducting attachments, or in numerous ways.

In the engine having its solar magnet's face on the inner circle, as in fig. 3, it will of course be seen that the planetary magnets are inside of its faces or circles; whilst with the solar magnets, as in figs. 1 and 2, having its faces on the outside of the circle, the planetary magnets must revolve outside of the face of the solar magnet; and with the solar magnet, having both the inside and outside circumferential faces, as in fig. 4, there must be two series of planetary magnets, the one to revolve inside, and the other outside. And also, when the solar magnet, figs. 1 and 2, is combined inside the solar magnet of fig. 4, and at the same time the solar magnet, fig. 3, is combined outside of fig. 4, these two series of planetary magnets have the whole attractive and repulsive power of these four solar faces thrown on them, to furnish appropriative power to the engine. When numerous series of planetary magnets are employed, presenting themselves to different solar faces, each series of planetary magnets should have its polar ends let into, and should stand between, two wooden rings or cylinders, having arms connecting them between the magnets, and extending from both series to a hub, by which they concentrate their power in its, their common centre or shaft, as the appropriative power of the engine. The heads or polar ends of the planetary magnets may have their faces curved, coincident with the inner and outer curves or circles

of the rings holding them; and the straight magnets, having their heads or polar ends enlarged each side of the coils of wire, are best to present their faces to these combined solar surfaces.

In this system of magnetic machinery, the planetary path, EE, in figs. 5 and 6 respectively, by way of variable capacity, may be considered as composed of covered brass, or copper tracks, or electro-magnetic wires, conductors, or keys, the one half between the aphelion and the perihelion, on the one side of the solar magnet, separated from the other half between the perihelion and aphelion, on the other side of the solar magnet, by ivory or other non-conducting substance; and one of the planetary magnets, E, be a conical wheel or rolling ball of soft wrought iron; the said keys being one positively and the other negatively charged. In this case, the balls or wheels will be continuously changing from positive to negative, and *vice versâ*, as they pass the points of aphelion and perihelion, and thus run or roll around the solar magnet. In this instance, the planetary path need not be perfectly circular, but may be similar to the orbits of the planets, and the number of planetary magnets, wheels, or balls, with their respective paths or orbits, may be increased to any such number as the face, or size of the solar magnet, will admit of presentation to it. This variable capacity of the system, it will be perceived, is not so well calculated to give appropriative power, as where the power is imparted to the central shaft L, as described, which may in this case also be done by coupling the two balls, by means of a wire running through the shaft L, jointed if the path be an orbit, or not jointed if it be circular.

Another variable mode of employing the solar magnetic principle, or character, is displayed by fig. 9. This variable mode consists in providing the solar magnet with eight circular faces, two faces to each pole AA, AA, AA, AA, so as to present four series of planetary magnets KK, KK, KK, KK, each series consisting of as many magnets as can be presented to the solar circuits or faces, to act in concert with them. This solar magnet has its four poles PP, NN, PP, NN, converging and diverging to and from its centre, and also the same poles diverging longitudinally.

Between the poles are wooden diaphragms ZZ, ZZ, ZZ, ZZ, to separate the negative and positive coils of wire that magnetize it by means of the galvanic batteries; the letters P between the poles denote the positions of the coils of wire positively charged, while the letters N denote the coils negatively charged, and the letters P on the poles, denote the positive poles, while the letters N on the poles denote the negative poles. By changing the wires from the positive to negative, and of course *vice versâ*, these poles change in like manner.

This solar magnet is, of course, continuously circular; fig. 10 is a side view of it. When the four series of planetary magnets, KK *et al.*, are presented to it, a cylindrical base, M, supports it, and the lower series of planetary magnets revolves inside of the cylinder base. The lower series of magnets may be dispensed with, losing however its effective power; and in that case, the lower diaphragm may be extended down, and form the cylinder base; or the lower side of the solar magnet may rest on a flat wooden base. The series of planetary magnets within and outside of the circuit of the solar faces, approach and recede the same as those in the other figures; and the upper and lower series of planetary magnets approach and recede as they revolve about the solar faces, by the planes of their revolution being at acute angles respectively, with the planes of the solar faces, or the side solar faces, caused by inclining their respective axles, or shafts, on which they revolve.

The axles are stationary, and sustain the shaft L, of the inner and outer series of planetary magnets, and the hub or centre of the upper and lower series rests and moves on friction rollers; the said axles or shafts may also be made to revolve with them, by toggle-joints or bevel cog-wheels connecting them to the central shaft L.

These series of planetary magnets change their poles at the points of perihelion, or nearest approach, and aphelion, or farthest recedure, as they revolve around or about the solar faces, similar in mode or principle to those presented to the other solar magnetic faces.

It will be apparent to any person, from this description, that the number of solar magnets, and that the number of series of planetary magnets to constitute a single engine, may be increased to any extent, on the system herein set forth. Also that the solar magnets may be slightly changed in form, and still preserve the same distinctive principle or character; for example—the poles of solar magnets fig. 1, fig. 3, fig. 4, respectively, instead of extending parallel to each other, may converge or approach each other, and thus resemble more minutely the horse-shoe curve; in this case, each pole, instead of presenting the form of a plain ring, would be the frustrum of a cone, or, if with a curved side, the segment of a hollow sphere. The planetary magnets may also be slightly modified in form,

still observing the general principles here laid down in their relation to the solar magnet or magnets.

And various modes, the principle of which is well known, for wrapping the horse-shoe magnets, may be employed for wrapping the solar magnets with the covered wire, to charge them as highly with magnetism as possible. The ordinary magnets are found to be most highly charged by wrapping each pole with several series of coils, the positive being the proximate or commencing wire for one pole, while the negative is for the other; I apply this system to the solar magnets. And I wrap the positive portion on one side of a wooden or other suitable diaphragm, and the negative on the other side, carrying the wires from one to the other side, through the diaphragm, when and as I wrap numerous series of coils, the one over the other successively, and also when side by side. The diaphragm may be dispensed with, but it allows a greater body of wire to be coiled when desired *without contact:* and, if desired, still a greater body can be coiled with the positive and negative *not distinctively separated*, by dispensing with the diaphragm. I carry the positive and negative wire of each series of coils respectively, through an ivory bush let into the respective side of the solar magnet, by which the wires do not interfere with the faces of the solar magnet, and they charge it heavily with magnetism. The upper wires are generally led over the upper side, on a wooden flanch or ring (two of which hold the outside coils in contact with the outer sides of the poles respectively), until they reach near the centre of the solar magnet, where they are led down through its supporting wooden column, or, if metal, through an ivory bush, and, together with the lower wires, are attached to their respective poles or natures of the galvanic battery. To charge the solar magnet or magnets heavily, and thus make them most efficient, the galvanic battery or batteries should always be used; and the planetary magnets, owing to their change of poles at the points of aphelion and perihelion, should always be electro-magnets, or made magnetic by means of the galvanic batteries.

Having fully described the principle or character of my invention, so as to enable any mechanic of ordinary ability and skill to understand its nature, and to construct and use the same, I wish it to be understood that, as respects the planetary magnets in their separate natures, I do not claim them; they being only the ordinary and well-known kind of magnets. But I do claim to be the original and first inventor of the solar magnet, in its principle or character, and the various modes of constructing it herein set forth.

I also claim the mode of combining or placing any or all of said solar magnets relatively with each other or together, as described.

I also claim the combination of the engines described, on the same shaft, or around the cog wheel, or with the horizontal shaft, to which they unitedly impart their power, as described.

And finally, I claim the application of the planetary magnets to revolve around or about the solar magnet or magnets, substantially in the manner and on the principles herein described.

WM. W. HUBBELL.

Additional Explanation of the Figures.

Fig. 4. The solar magnet, fig. 1 and 2, may set within this one, and thus have three solar faces acting on two series of planetary magnets, the inner series as in fig. 5 or 6, and the outer series as in fig. 1 and 2, both series affixed to the same shaft.

Fig. 3. This formation of solar magnet may set outside of the form fig. 4, and thus have *four* solar faces acting on two series of planetary magnets; this fig 3 being relative to the planetary path, either as the outer magnet in fig. 5, or as the outer magnet in fig. 6.

Fig. 5. L is the centre of the planetary magnets' path EE. AA of the inner solar magnet is the north pole, while AA of the outer solar magnet is the south pole, and *vice versâ*. I is their centre. P is the face, and S the back of the inner solar magnet. R is the face, and T the back of the outer solar magnet. WW are two of the planetary magnets, of which EE is the path.

Fig. 6. L is the centre of the planetary magnets' path EE. AA of the inner, and also AA of the outer solar magnet, are both either north or else south poles at the same time. II are their respective centres. S is the back, and P the face of the inner solar magnet; and T is the back, and R the face of the outer solar magnet. WW are two of the planetary magnets, of which EE is the path.

W. W. H.

ON ANHYDROUS STEAM, AND THE PREVENTION OF BOILER EXPLOSIONS. BY DR. HAYCRAFT, GREENWICH.

Sir,—The attention of your readers has been attracted by the communications in your valuable Journal, of Mr. Frost, of New York. He has with much talent developed his views on dry or anhydrous steam, which, on the supposition of its having its own atomic constitution, he denominates *stame*. He has given experiments which open a vast field for improvement, and his conclusions lead us to believe that the power of the steam engine may be prodigiously increased. Having, about twenty years since, entertained nearly the same views as Mr. Frost, and having abundant reason to modify them, it may not be amiss to give an historical detail of the principal facts on which those opinions were founded. It will be at least advantageous to the reader, by warning him of those errors by which I have been misled, and will at the same time open to him the right path to improvement.

Being induced by the experiments of Broughton, who supposed that steam was 10,000 times rarer than water, and also by those of Desagulier, who put it down at 14,000, I experimented by weighing steam in a copper ball, and afterwards weighing the same after having immersed it in boiling oil for some time, for the purpose of superheating and rarifying the steam. The particulars of this experiment I need not detail, as it is, I now perceive, liable to the same objections as Mr. Frost's, which I will afterwards explain. The result was, that by exposing steam to the temperature of boiling oil, its specific gravity appeared to be lessened to about one-tenth; that is, it expanded to about ten times its former bulk.

Encouraged by this apparently satisfactory experiment, I had a small steam engine constructed, with a cylinder of 4 inches, and furnished with a tubular condenser, by which I could measure exactly the quantity of steam consumed. The cylinder was furnished with a jacket, which was supplied by a small high-pressure boiler.

On working the engine with ordinary steam, it required 85 revolutions to fill a given measure with the condensed steam; but on applying steam to the jacket of about 500 lbs. pressure, it required 920 revolutions to fill the same measure—the engine in both instances carrying the same weight on the paul. In this experiment, which was often repeated, it appeared that dry steam, or Mr. Frost's *stame*, is ten times more economical than ordinary, or hydrated steam.

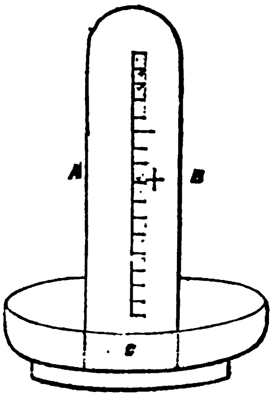
Having succeeded thus far, a high-pressure engine was erected, with a 9-inch cylinder and 3 feet stroke; the cylinder was so constructed that a fire could be made round it, and at the same time the supply steam passed through tubes exposed to the heat of the furnace flues. The engine worked very well for some time, and with surprising economy of fuel; but, as might be expected, the parts exposed to high temperature gave way, and the engine became useless.

Afterwards I had a small engine, with the cylinder immersed in a mercury bath, with a metallic piston; this engine also gave great satisfaction for a time. It however occurred to me one day to make a calculation of the actual working of these engines; and I found, to my astonishment, that, although my rarified steam or "*stame*" had, as I believed, ten times the rarity of ordinary steam, yet its performance was in all these cases about equal to what it should be, supposing it to have the rarity ascribed to it by Watt—namely, 1728 times greater than that of water. On examining this subject carefully, I fortunately recollected the remarkable admission of Watt, that in his best engines, there was a consumption of steam double of what was required by calculation. We have here two remarkable facts: one is, that a large engine, of Watt's best construction, consumes twice as much steam as it should by calculation; and the second is, that a small engine, carefully made, requires ten times as much as is sufficient under a different management.

This must be explained either by supposing there is some waste in the usual mode of operating with steam, or that, by superheating it, there is an absolute expansion of its volume.

To settle this latter point, the following experiment was made, which, though performed many years since, has never been published. The experiment was designed to ascertain the density of steam,

but chiefly to determine what effect a superheating of it would produce.



A B is a graduated tube filled with mercury, the upper end being closed, and the lower immersed in a basin of mercury. Oxygen and hydrogen were introduced in the proportions which constitute water, to a certain mark which was noted. Two coated wires being introduced at the lower end, the gases were detonated, and, of course, reduced to water. The whole was placed in an oil bath, gradually heated to 210°, when steam was formed filling the tube to the mark +. On this, a calculation was made which came so near 1728, the expansion assigned by Watt, that I was satisfied of its general correctness. Having ascertained this point, I proceeded to determine the other, which to me was of the greatest importance, namely, how far an additional temperature would expand the steam, expecting that, at all events, it would have as much effect as is ascribed to it by Gay Lussac and Dalton, namely, as doubling the volume for every 480°. My surprise was indeed great, when I found that an increase of 10° made no perceptible difference in the volume of the steam. I then gradually raised the temperature of the oil bath to 285° without perceiving the least expansion; indeed, it appeared very slightly to have contracted its bulk—arising, I suppose, from the expansion of the glass tube. I did not raise the temperature higher—my apparatus, unfortunately, not admitting of it—and I was completely satisfied that an additional temperature of 75° did not expand the steam. The experiment was several times repeated with the same result.

How can this experiment be reconciled with those of Mr. Frost, who finds that an addition of 4° doubles the volume of the steam? There is such an air of candour about Mr. Frost's communications, that I am disposed to give full credit to the facts which he details; and the only way I can think of to reconcile the discrepancy, is to suppose that some mismanagement has taken place either in his experiments or mine. On examining his apparatus, as represented in figs. 4 and 5, page 252, No. 1390, and his mode of using it, I find that the whole syphon is filled with water, which, being converted into steam at a high temperature, the superabundant water escaping, is thereby filled with *stame.* The syphon being then hermetically sealed up, was suffered to cool;—an engineer's vacuum, as he aptly terms it, is formed. Now, in this process it must be observed, that the whole interior of the syphon must be covered by very minute globules of water. The mercury is then introduced, which would fill the syphon with the exception of these minute globules, which would be everywhere interposed between the quicksilver and the inner surface of the tube. Then, on applying heat at the boiling point, the globules of water at the upper part of the syphon only are converted into steam; the remainder is kept in the aqueous form by the weight of the column of mercury incumbent upon it, so that it is no wonder that an addition of 4° temperature would convert some of the globules of water into steam of double the whole column. The other instruments used by Mr. Frost are still more complicated, and I fear in their use would give rise to the same errors; and, as all the experiments were conducted in nearly the same manner, the results would be similar in them all. In such experiments the utmost care should be taken to operate in perfectly dry tubes.

Having said thus much in reprehension of the mode in which Mr. Frost's experiments were conducted, I will gladly take this opportunity of acknowledging the great importance of the experiments themselves, and of the relation of oil of turpentine and the fixed oils to minute globules of water exposed to

high temperatures. His papers deserve a most attentive perusal, especially his remarks on boiler explosions, to which we shall refer.

We shall now be able to return with advantage to the fact, that in the small engine spoken of, as an additional temperature does not expand the steam, and as when the steam was superheated the engine consumed only the quantity that it should have done by measurement, it will follow that the same engine, when it was worked with ordinary steam, and consumed ten times as much as in the former case, must have consumed ten times as much as it ought to have done by measurement. Then comes the question, What occasions the loss? The same question applies to the other case, namely, What occasions the loss of one-half of the steam, which, we have seen, was the opinion of Mr. Watt himself, in his best engines? It has been stated that Watt ascribed this loss to unavoidable leakage by the piston, &c.; but on consulting several engineers on the subject, it appears that no very considerable loss could happen from this cause, as he took great pains in the finishing of his cylinders and pistons. It also appears that he had at least a suspicion of the true cause, which will be hereafter explained; namely, a cooling which takes place within the cylinder. The evidence of this is, that he took great pains to prevent it by clothing the working cylinder with non-conducting substances, and even by surrounding it with steam in a jacket.

While conversing with my brother on this subject, he remarked that he thought the cylinder was cooled by the evaporation which took place within it during the time of the vacuum, as the interior surface must be covered with a film of water every time the steam is admitted. The cause of the evil now appeared quite clear. The engine at first starting is, of course, colder than the steam; it therefore becomes loaded with the water; a vacuum is made in the cylinder; the water within is rapidly converted into steam; it derives its combined caloric (1000°) from the metal of the cylinder and piston; these are cooled down by the abstraction of as much caloric as entered into the composition of the steam thus evaporated. Again; the supply steam is admitted into the cooled cylinder, and is condensed until the apparatus is raised to its own temperature; and not till then does it begin to act. Hence arises a fresh deposit of water, which is again evaporated with a production of cold; and thus the process continues as long as the machine acts. And here it may be noted, that this process constantly takes place in double-acting engines, for the vacuum process is constantly occurring either above or below the piston. On the other hand, in the bastard or Cornish engine, the vacuum takes place alternately, and only during one-half of the time the machine is in action. This may well account for the general economy of this machine. In addition to which, the adaptation of the steam jacket—a fact now ascertained—will, as Mr. Frost observes, explain in part their vast superiority. The clothing of the boilers and steam pipes, and of the cylinder, together with the management of the furnaces, may also be considered subsidiary to their effect. Having thus ascertained the cause of the great waste of steam, it now became the question, How was it to be remedied? It was evident the plans hitherto pursued would not be practicable. It would be impossible to surround the cylinder with steam of the pressure of 500 lbs.; and I had ascertained that less would not effect the object even on so small a scale. Also, I had found that passing steam through metal pipes, exposed to the action of the fire, or of heated flues, was attended with practical difficulties which were insurmountable. It then occurred to me that, as it was only required to raise the temperature of the cylinder a trifle above the condensing point, this might be effected, provided the whole of the supply steam were raised to an equal temperature, and that all uncombined water were prevented entering with it. In order to effect this, it was necessary to have a very extended surface applied to the heating steam. I found afterwards that a faggot of tubes, being surrounded by the same steam that heated the jacket, answered the purpose. This faggot, being enclosed in a portion of the steam pipe, or in the heating boiler, I called a siccator.

The apparatus was applied to an engine belonging to Mr. John Penn. This engine was employed in turning one pair of millstones, and it was ascertained by measuring the coals and wheat, that

the consumption was 3·6 lbs. coals for each bushel of wheat ground.

This, considering the smallness of the engine, and its being of low pressure, is less than in any engine yet known; for even Woolf's engines on a large scale, with high-pressure and expansion cylinders, consume from 3 lbs. to 6 lbs. for each bushel. I have since ascertained by calculation, that this engine expended little above 8 per cent. more than it should by measurement, while even the Cornish engine expends 33 per cent. more than the proper quantity.—(*See* Appendix).

On experimenting, however, with this engine, I found I had not produced the maximum effect. In order to explain this clearly, I will state the mode by which this was ascertained. The index of the injection valve was set to a given point; the temperature of the injection water was ascertained, also that of the hot-well; the difference of these in any one experiment compared with the difference between them in another, the quantity of the injection being constant, will give exactly the comparative quantities consumed in each case. By experimenting in this way, I found that on raising the pressure of the heating boiler from 30 lbs. to 60 lbs., and even to 120 lbs. on the square inch, the temperature of the hot-well still diminished. This put me to contrive again; for it was evident that such high pressures were inadmissible, and yet I was desirous of producing, if possible, the maximum effect. A plan then occurred of a priming or separating-box of a very simple construction, which by giving a circular motion to the supply of steam before entering the siccator, would by the centrifugal force acquired by the free water which always rises from the boiler be separated and fall to the bottom of the apparatus. This priming-box was consequently applied, when I was gratified by observing its effect; for on raising the temperature of the heating boiler from 29 lbs. to 90 lbs. no diminution of temperature took place in the hot-well. This was a full proof that the maximum power of the steam was produced. The pressure of the heating steam was afterwards diminished to 15 lbs. on the square inch, on which an increase of temperature took place in the hot-well of 5 per cent. The pressure in the supply boiler was 6 lbs., so that a difference of about 9 lbs., or about 18°, is sufficient to enable steam to produce nearly its full dynamic effect. This difference would suffice, but by increasing the surface of the tubes in the siccator, the maximum effect may be easily produced at a less temperature.

About this time the matter came under the notice of the Admiralty, and the Lords were pleased to grant a sum for experimenting on this engine. The experiments were conducted on the same plan as before, except that a dynamometer was applied, which was loaded to indicate about 18 horses power; which same power was also shown by the indicator. The experiments were under the inspection of the Comptroller and Inspector of Steam Machinery, and performed by Mr. Wright, one of the engineers of the Admiralty. The experiments were comparative, and showed the expenditure of steam under equal loads; first of the engine without steam in the jacket, then with ordinary steam in the jacket, and lastly, with the siccator, &c., as above described, added to the engine. The temperatures given to the injection water being ascertained, and the power being inversely as these quantities, it appears that the apparatus produces a saving of 25 per cent. compared with the engine with ordinary steam in the jacket, and of 46 per cent. compared with the engine without steam in the jacket.

(*To be continued.*)

GEOMETRICAL NOTES. BY T. S. DAVIES, ESQ., F.R.S., F.S.A., ETC.

(Continued from page 267.)

II. *On some of the Fundamental Principles of Geometrical Reasoning.*

There is another oft-debated topic that comes in at the threshold of geometry, and which is constantly appealed to in discussing the first principles of the Greek form of the science. It has, indeed, been spoken of at some length under one aspect, that of supraposition or transposition; and is itself the *idea of motion*. A very large class of modern geometers disapprove of any introduction of motion into pure geometry, and as if to express their contempt, call it "a mechanical proof" when any such idea is introduced. Certainly such doctrine has not been learnt from Euclid;

nor does it appear to me justified by any single attempt out of the hundreds that have been made, to modify Euclid's processes conformably to this view. No doubt there is something very pleasant to the imagination in the notion of etherealising any system of science, so as to make it as little dependent on the suggestions of sense, as though its orgin were amongst a superior race of intelligences—in the idea of rendering geometry the result of what Kant calls "pure intellect." This pleasant dream is, however, disturbed by the constantly-recurring question—"*can we create such a system?*" Unfortunately, as far as past efforts can hint respecting the future, the prompt reply is —"No!" Man's vanity of superior intellect has not yet been thus evinced; and we are entitled to ask whether it can be?—and likewise whether such a feat, if accomplished, is one to be so excessively desired? My own conviction is on the negative side of both questions.

In the first place, it may be asked (as a metaphysical antecedent to all geometry), do we, or can we, form any idea of space at all, without the suggestions furnished by the *experience of motion?* It is not denied that we can and do, in our own thoughts, separate the conception of motion from that of space: but this is a subsequent act of the mind, and does not prove that the conception of space could have been *originally formed*, had the phenomena of motion been excluded from our sensations. If this be the case, why are we (merely because we afterwards, "clarify" the complex conception from its so-called impurities), justified in claiming for even the conception of space itself a purely intellectual origin? If we cannot, apart from the sensitive part of our nature, at once form the conception, it is quite clear that, after all, we are not so independent of material suggestion in the formation of our geometry as that hypothesis supposes us to be. In fact, it comes back to the doctrine of prototypes or innate ideas, which even in the school of Plato were not used for such a purpose; though, could it have been done, it would have availed much, both in the metaphysics of the school and in the geometry of Euclid. But this, though an argument conclusive to my own and to many other minds, will not, perhaps, be conclusive to all.

Again,—if we are to dispense with all idea of motion, how happens it that we still retain the construction of problems, or even adopt the postulates respecting the line and circle as given by Euclid? Surely there is as much motion implied in *drawing* a triangle or circle, as there is in *transposing* either of them. The motions may have a specific difference: but they are both alike *motion*, after all. Deny the employment of motion, and *the use of every problem is at once excluded from the system.* We must hence hypothecate in each case the point, line, or circle, as actually existing, without showing how to find it, or even that its existence is possible! In some few simple cases, perhaps, this may be safely done, where belief rather than demonstrative method is the object (as *i.* 10): but how do we even know that such a figure as an equilateral and equiangular pentagon can exist at all, if we adopt this principle? In short, we must not attempt to follow in the wake of Euclid in the construction of our geometrical systems, if we wish to render them of that purely contemplative character which alike refuses the suggestions of sensation and the adoption of the principle of motion. Such a geometry must be, at least, whatever else it may be, composed entirely of theorems and axioms—the axioms including the statements of the existence of the things, which in following Euclid, we show how to find.

Many writers affecting this kind of purification of geometry from material grossness, direct us to "*conceive* that the triangle ABC is applied to DEF, *etc.*," (*i.* 4.) This simply mends the matter by making it worse. It acknowledges that it is upon the *material triangles* before them that they are actually reasoning; and at once gives up the supposed spiritualism of the whole system. Yet they will not have these material triangles disturbed: we are only to imagine what *would take* place if they were moved according to the imagined transposition. Yet whatever would take place under the forbidden circumstances which are only to be imagined to take place, can surely be true only to the extent that the conditions are fulfilled. If we are allowed to make the transposition actually, we can prove the conclusions to be inevitably and actually true: but we cannot infer an actual truth from the merely imagined performance of

what is actually essential to the proof. If the triangles be material, the transfer must be capable of something more than any imaginary operation. We might, if we proceed thus, imagine a perpendicular drawn to a line, a regular pentagon inscribed in a circle, or a conic section described through five given points, on the same authority and with the same facility. The truth is, that whatever is directed to be "conceived as done," must be actually possible, and admitted to be so either in consequence of an axiom, or a preliminary construction and its proof. In that case we may put it hypothetically, as done, or capable of being done, as may best suit our immediate purpose. Euclid puts it "*for if* AB be applied, *etc.*;" and in this he is perfectly right, whilst all attempts at emendation only lead us into very obvious contradictions.

The truth, however, is, that whilst sensible figures *suggest* the ideas, and the inquiries relating to them (and, indeed, almost the entire course of our inquiries), these sensible figures are not truly those to which our reasonings refer. These do not, even when most carefully drawn, rigidly fulfil the specified conditions;—arising both from the limited power of our senses to perceive, and the imperfect action of the instruments we use. A trace of the pen, however fine, is not the line of our definition; a dot, however minute, is a different thing altogether from a geometrical point. The things concerning which we reason are the things which we have defined and subjected to their defining properties only—not the figures which we draw to furnish a series of stepping-stones for the mind, nor those by which the idea of the real object of our contemplation was originally suggested. As far as the figures before us fulfil the defining conditions, so far they agree with that upon which we reason, and so far will our deductive conclusions apply to the figure before us, but no further. In an investigation I may sketch a figure composed, say, of straight lines and circles *by hand, and without much effort at accuracy*: still my reasonings are not vitiated, provided they conform to the *definitions* of the line and circle; nor are they improved if I draw the figure by the aid of the rule and compasses with the greatest accuracy in my power. In all cases, my reasoning is concerning a figure more perfect than either of these—in fact, absolutely perfect from its strictly fulfilling the conditions of its existence.*

Those persons who object to transposition, are required to explain how they obtain their *test of equality*. Invariably,

* Captious or careless readers might deduce as an inference from what has been said, that two points are virtually conceded; viz., the ideal origin of geometry, and the dependence of demonstration upon definitions. As these notes are not professed to be a systematic treatise on the fundamental principles of geometry, but merely as suggestive of what I deem to be correct views on several topics involved in a philosophical system of geometry and geometrical history, I might without impropriety, perhaps, leave them as they are: but as I am anxious to avoid misconception by even the most casual reader, it might be worth while to add one or two remarks further.

Geometry is thus far ideal. The objects about which it reasons are free from all the imperfections of material construction and from the limitations of human perception. The conclusions at which we arrive are only true of the figures which *perfectly fulfil* the defining conditions; and cease to be true when the figure is changed in the slightest degree, whether by a change in the defining conditions of structure, or by an imperfect instrumental fulfilment of them. It is an act of the mind that comprehends this perfection of figure; and so far it may be admitted to be ideal, that it is not verified in any actual figure that we can construct. But is the conception itself formed independently of the exercise of our own sensitive faculties? Or are the very axioms we are obliged to employ in the reasoning deduced independently of those faculties? If not, then, our geometry is ultimately resolved into a dependence upon the *suggestions* of our senses; although as a system we are able in part to clarify it from the imperfections thus attached to it. We are able to conclude from logical instead of experimental evidence—we are able to reason instead of measure.

It is this perfect definition of the subject of our reasoning that constitutes the mathematical the most certain of all sciences—it is one of the principal sources of the peculiar conclusiveness that is on all hands admitted to characterise this science. No question can be raised here as to whether the two premises relate to the same subject in the same sense; or, technically speaking, mathematics is the only subject in which we are not liable to the employment of "an ambiguous middle term." Why are logical writers so backward in pointing this out? No doubt the same reason that prompts them to confound (or, at least, to not discriminate between) the copula of identity and the copula of equality. They wish to show that there is no difference between mathematical reasoning and all other reasoning, when such reasoning is reduced into regular form; and to this extent they succeed perfectly. It would, however, be but fair to point out the particular circumstances that confer, on the applications of that reasoning to number and magnitude, a perfection of certainty that can be attained in no other.

As to the second anticipated objection—that my view throws geometry back upon the definitions as its basis, a very few words will suffice to dispose of that. We only throw back upon definition the subject-matter of the reasoning—not the entire syllogism, but *only one of the premises*, the other being always an axiom or pre-demonstrated proposition. But enough has been said to prevent misconception, and it is beside my purpose to meet mere *ad captandum* objections, or, indeed, sophisms of any kind.

as far as my memory serves me, the test of Euclid (*i. ax.* 8) is adopted even by the geometrical "quietists." Surely the two magnitudes must occupy the same space *successively*—the one being removed to apply the other. If not—how? It is true, indeed, that as long as only plane figures are considered, mere hypothetical supraposition might afford them a confused notion; but, in strictness, a figure supraposed on another does not fill the same space—at least does not occupy the identical space, which is evidently Euclid's view of the matter. A little attention to the manner in which Euclid compares equal parallelopipeds, would have disabused their minds of this error. It is not, however, worth pursuing further here.

There is one thing worthy of remark in Euclid's use of transposition. He never uses it in aid of constructing a problem. This is strikingly illustrated in his (*i.* 3); where, instead of *transposing* the line *c*, so that one of its extremities shall be at A, he employs the second proposition as a lemma, for *finding* a line AD *equal to* C, which shall have one of its extremities at A. These two propositions have indeed been the subject of more cavil by the "practical-geometer" class than any two perhaps in the whole range of the elements. Of course it is not to this class that any of these notes are addressed; as such persons are incapable of estimating the views under which Euclid composed his immortal work. They are quoted here to illustrate a *principle* that runs through the entire "Elements:"—that transposition is never used in aid of the construction of a problem.* Indeed, were it admitted into construction, what kind of a geometry should we soon have?

But, finally, what are we to understand in reality by the word "*mechanical?*" Are any of the conclusions of geometry to be understood as being deduced from physical properties of material bodies? Are any of our theorems obtained by investigating the laws of force by which our figures were produced? Or as dependent on any statical property of a system of material bodies? If not then, what degree of precision is attached to the term "mechanical" when applied to demonstrations in pure mathematics? In order, however, to avoid all chance of being misunderstood, I will take an example.

The most remarkable class of approximations between pure geometry and physics, perhaps, is that which relates to properties in all figures admitting of identical formulæ with those which relate to the centre of gravity of a system of bodies rigidly connected. It happens that when the physical point is defined, and one single property known, a considerable number of conclusions can be deduced almost entirely from physical considerations alone, or with extremely little aid from mathematics. These properties might be said to be perfectly proved by such considerations as regard the centre of gravity of a physical system (whether in the best manner or not, is no part of the present question); and we feel that we may infer the truth of the same properties existing likewise in a purely geometrical system. It is, then, such a proof as this inference would be, that I understand as a "mechanical proof;" and it is to such proofs, or those having some analogy to it, that I think the phrase should be confined.

The point was first noticed as a *physical* one, and a corresponding name imposed upon it. It was only gradually brought into notice as a *geometrical* one, and for ages attracted, as such, only slight and casual notice. Indeed, till near the close of the last century, the physical properties were made the basis of the slipshod demonstrations of the analogous geometrical ones;* and, of course, there was

* Is it possible that considerations of this kind gave rise to the clumsy process by which *i.* 8 is proved by Euclid, considering *i.* 7 as an element of that proof? The very obvious and familiar demonstration by placing the triangle with its vortex on the *opposite* side of EF from D, and then joining the two vortices of the triangles thus situated, would, I can hardly think, have escaped Euclid's notice; and the more especially as he has adopted a method precisely the same in principle, and differing solely in his being able at that stage to construct the triangle instead of transposing it. It is at least not improbable that his objection to the mixture of transposition and construction which would have been involved in the adoption of the proposed method, was the ground of his rejection of it. Many of the early difficulties encountered by Euclid originate in his deferring the introduction, except as an instrument of construction, till so remote a stage in his development: but further prosecution of this subject here would be anticipating what I shall have to say upon Euclid's general principles of classification.

* The following is a case in point, taken from Dr. Hutton's translation of Montucla's Recreations, *p.* 7, *vol. ii.*, 1814. The proposition is (*i.* 354) attributed to Buffon, and is treated as impossible to

no attempt made to give the geometrical point a more suitable name.

Carnot, however, who was both a philosopher and a geometer, happened to get into a course of *geometrical* researches which involved a considerable number of properties of this point. His was not a mind to be satisfied with this unphilosophical admixture of geometry and physics, especially in such a reversed form as to make physical considerations the basis of geometrical truth. Of course *he* could not but succeed in distinguishing them; and only the name of the point was left to remind him of their being mere physical properties. In that age of verbal, as well as political, social, moral, and religious revolution, there was sufficient license for the innovation; and from a property of the point, he was led to call it the "*centre de moyennes distances.*" To this name he always adhered; and it is now universally adopted by the French geometers in all geometrical considerations of the point. The chief objection to it is, the length, and the somewhat unmeaning form which a literal translation of it into English, takes. I ventured a few years ago (in the Transactions of the Royal Society of Edinburgh, *vol. xvii.*), to propose the term *centroïd* (centre-like) for the geometrical name of this point; and I am not without a hope that its brevity and its expressiveness will ultimately lead to its general adoption.

The properties of this point in a geometrical system are no longer dependent for their evidence upon mechanical proof. Neither, indeed, does it appear so likely that the centre of gravity will hereafter be able even to suggest properties of the centroïd, which independent and direct investigation has not already anticipated. Besides Carnot's, considerable numbers have been directly investigated by Lhuilier, Gerono, and others. But to pursue this would be irrelevant.

We are now entitled to conclude, if my reasoning contains no very grave fallacy, that:

(1). That the Greeks received geometry from the Egyptians, not as a practical art merely, but as a methodised science; not only composed of constructions, but of demonstrations also.

(2). That the mode of demonstration so received was effected chiefly by supraposition and the method now known as *reductio ad absurdum.*

(3). That the method of making one truth subservient to the demonstration of another, and the consequent employment of the direct categorical syllogism in effecting the proof was almost wholly (if not entirely) due to the Greeks.

(4). That the Greek geometry loses something of its beauty from the rejection of the logic of Aristotle, by the disciples of Plato.

(5). That though there is an obvious desire manifest throughout the Elements of Euclid to dispense with the use of motion, transposition, or successive occupation of space, there is little to justify the belief that the Greeks encouraged a hope of success; whilst almost every page bears witness to Euclid's conviction that he had not accomplished it.

(6). That there can be no *reasoning* in geometry without the assumption of axioms.

(7). That the peculiar evidence at-

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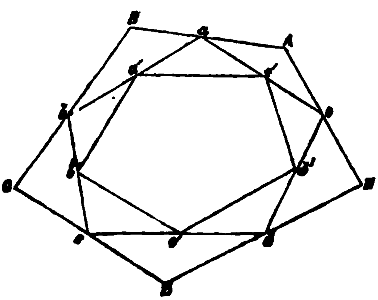
be solved by considerations purely "geometrical." This inference is, however, a too hasty one, as I propose to show hereafter—the present not being a suitable occasion.



"If each of the sides of any irregular polygon whatever, as ABCDEA be divided into two equal parts, as in *a, b, c, d, e;* and if the points of division in the contiguous sides be joined, the result will be a new polygon *a b c d e a:* if the same operation be performed on this polygon; then on the one resulting from it; and so on *ad infinitum;* it is required to find the point where these divisions will terminate."

"To solve this problem, if we suppose equal weights placed at *a, b, c, d, e,* their common centre of gravity will be the point required. But to find this centre of gravity, we must proceed in the following manner, which is exceedingly simple." He then gives the ordinary method of finding the successive centres or gravity of two, of three, etc. No proof that the point sought would be the centre of gravity is offered. Had he done so, then the proof would have been valid as a *mechanical* process."

This, and a few others which engaged my attention at the same period as the "flat knot," might hereafter serve as its *compagnons du voyage* down the stream of time; and if they serve no other use, may show that even into our more intricate puzzles, a little of science may sometimes enter.

tached to geometrical conclusions, arises from the two circumstances:—the nature of the copula in its argument, and the absolute identity of the "middle term in both the premises of its syllogism.

(8). That the term "mechanical" is absurdly applied when applied to Euclid's method of transposition; and that no system of geometry is within the reach of our faculties, which does not admit of this principle.—(*To be continued.*)

HOW THE FRIMLEY TRAGEDY MIGHT HAVE BEEN PREVENTED.

About three years ago we gave an account of the "Electric Indicator,"—an invention of our old and esteemed correspondent, Mr. Rutter—being shortly after the time when the specification of it was enrolled (see vol. xlviii., p. 36.) A lamentable tragedy which has just occurred on the borders of Surrey has forcibly recalled to our remembrance the great utility of this apparatus as a means of protection against the midnight burglar and assassin. Had the parsonage of Frimley only been provided with such an apparatus, the unfortunate incumbent might still have been spared to his family and his parishioners, and a great crime involving (very surely) more death and destruction in its train prevented. Who would think of breaking into a house if aware that the moment he opened a door or window, or stepped across the threshold, that moment his burglarious presence would be announced by a peal of bells, rousing the inmates to stand on their defence, and calling on their neighbours to come to their aid? The intending thief or murderer his own certain detector and denouncer! Or who, with such a protection against sudden surprise, would care how secluded or lonely his dwelling might be? How the apparatus we have referred to accomplishes all this and much more in the way of domestic security and comfort, country gentlemen and others may learn for twopence, by sending to Messrs. Horne, Thornthwaite, and Wood, of Newgate-street, for a copy of a small and very interesting pamphlet which Mr. Rutter has just published, descriptive of the construction and various uses of his apparatus.

THE SUBMARINE TELEGRAPH BETWEEN ENGLAND AND FRANCE.

We learn from certain published proceedings of an Anglo-French Company, which has been formed at Paris for carrying out the project of establishing an electric communication between England and France: 1st. That negociations are in progress for raising 50,000*l.*, which is the sum estimated to be necessary for the purpose, and with every prospect of success. 2nd. That experiments are now being made at Dover with a new description of cable "of from four to five inches in thickness, composed of gutta percha, inclosed in wire rope, all chemically prepared," and that it is intended to have two such cables, each 20 miles long, and 3 miles apart, and each of such weight as to be capable of resisting the anchor of a 120-gun ship. And 3. That the whole of the permanent wires and work are expected to be completed by May next, "when it is proposed that Prince Albert and the Duke of Wellington should open the communication on one side of the Channel, and the President of the French Republic on the other." We sincerely hope all this may turn out to be true, but we must confess we do not quite like the present aspect of things. The great thickness of the proposed cable—without any explanation of the necessity for it, or the means by which a rope of such thickness and such length (20 miles!) is to be manufactured, carried, and laid down, or if made in separate pieces *how* and *where* the pieces are to be joined—is still, to our minds, rather a startling obstacle in the way; and the talk about providing against the possible case of the anchor of a 120-gun ship dragging against the cable, shows such a care for imaginary contingencies in the face of the actual difficulties of the case, as looks liker stock-exchange tactics than real business.

THE TWO VOLTAS.—CURIOUS COINCIDENCE IN NAMES.

"Pliny tell us that it appeared from ancient annals, that by means of certain sacrifices and ceremonies, thunder could be made to descend, or at least that it could be obtained from the heavens. An ancient tradition relates, that this was practised in Etruria among the Volscinians, on account of a monster, called VOLTA, which, after having ravaged the country, had entered their city, and that their king, Porsenna, caused the fire of heaven to fall upon it."—*European Magazine*, vol. xxii., October, 1792, pp. 263-4.

Animal electricity was discovered by Professor Galvani, of Bologna, in 1791, but the discovery was extended by VOLTA, and is, consequently, better known as "Voltaic Electricity," *than* as "Galvanism."

The above was communicated to me by

my friend Dr. James Brett, R.N., late Principal Physician of Haslar Hospital, Gosport.

ARTHUR TREVELYAN.

FALL OF A RAILWAY IRON BRIDGE IN AMERICA.

We quote the following notice from the *Scientific American*, of August 10 last:

"*Accident on the Erie Railroad.*

"On Wednesday the 31st ult., while the down freight train was crossing the iron bridge, three miles above Lackawaxen, it gave way, precipitating the train into a creek. The train was very heavy, consisting of 20 cars, with 500 sheep, 200 hogs, and 100 head of cattle. Only 25 of the cattle and 100 sheep were saved. Five men were killed—three brakemen and two drovers. When the locomotive came on to the bridge, the engineer felt it settle, when he at once put on more steam, which carried the engine over, but the tender parted, falling down into the ravine, and fifteen of the freight cars tumbled down on the top of it.—The loss is about 10,000 dollars in property—the lives of the men being above valuation. The bridge was 62 feet broad and 95 feet high."

MR. BILLS'S CUBIC SOLUTION.—(P. 252.)

Sir,—May I request the favour of your desiring Mr. Bills to furnish the *investigation* of his rule? We cannot adopt formulæ on trust; and without intending any slight upon the author of the rule, we can make no exception in favour of his special authority.

P. Q.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING OCTOBER 10TH, 1850.

JOSEPH FINDLAY, of Paisley, Renfrew, manufacturer. *For an improvement or improvements in machinery or apparatus for turning, cutting, shaping, or reducing wood or other substances.* Patent dated April 5, 1850.

This "turning" machine or lathe of Mr. Findlay is intended principally for the manufacture of bobbins for winding thread, cotton, or other similar materials, but may be so modified as to be applicable to the production of button moulds and other articles where many of the same form are required.

As applicable to the former purpose, it is described as consisting of a bed or stand, on which are two standards or bearings to support mandrils, as in ordinary lathes;—one fixed, in which revolves a mandril terminating in a ribbed arbor or holder, and driven by a band and pulley;—the second moveable, to suit the size of the article to be turned, and supporting a mandril or rod, sliding longitudinally, and connected to a lever whose fulcrum is on the side framing. The cutters are two in number; a plain or roughing tool, which consists of an ordinary chisel and two gouges, by the action of which the rough blank is reduced to a cylindrical form; and a compound finishing cutter, consisting of a plain chisel, at each end of which is a chisel set at an angle to form the bevel of the ruff or collar of the bobbin or reel, and two other chisels which cut down the ends. These cutters have a traversing motion towards and from the material under operation, which is imparted to them by a crank lever, the end of which is attached to a driving shaft at the opposite extremity of the frame. This shaft also bears the stop or disengaging motion, consisting of a fixed clutch, into which a corresponding moveable clutch takes, which is kept in contact by a helical spring attached to the side framing. The moveable mandril or rod is produced and terminates in a slope, which rests on the boss of the second moveable clutch piece, which is sloped, to allow thereof, to a corresponding angle. This rod also bears an angular bar, one end of which has an eye fitting over the first mandril between the standard and its arbor. When the lever is drawn back, the holder of the moveable mandril is released from the bobbin, the sloped end of the rod bears against the boss of the moveable clutch and detaches it, the angular bar slides forward by the same action, strikes the finished bobbin, and removes it from the arbor, and bears also against the cutters which are now at that part of their traverse furthest from the bobbin, detaining them whilst another blank, properly bored, is introduced between the mandrils. On bringing the lever forwards, the moveable clutch is released, and, by the pressure of the spring, at once gears into its corresponding toothed piece, and the stop bar having been moved back by the advance of the lever, the cutters escape, and are allowed to complete their traverse towards the blank, which is held firmly between the mandrils, and which, when finished, can be removed by a repetition of the action above described.

The machine may be used without the stop bar, but the attendant must in that case time his movements accurately, so as to displace the finished bobbin and insert a fresh blank between the mandrils while the cutters are making their retreating traverse. In place of the crank lever various other contrivances to effect the same object are described by Mr. Findlay (see claim 7). As also a modification of the same machine

which is so constructed as to be altogether self-acting. The different mechanical appliances therein employed in addition to those above mentioned constitute the subject matter of claims 5 and 6.

Claims.—1. The general construction and arrangement of the machinery or apparatus described, and its application to the cutting or shaping of wood, or other suitable material, into bobbins and other articles producible by such machinery or apparatus.

2. The system or mode of cutting or shaping the substances, from which bobbins or other articles are to be made, wherein both cutters or tools traverse simultaneously towards the material to be cut during the greater part of their stroke, the plain or roughing cutter being made to come into action slightly before the finishing tool.

3. The adaptation or employment of stop or disengaging apparatus, as described.

4. The system or mode of traversing the cutters in such manner that the rate of motion shall be slower at the instant of cutting than during the period of their traverse towards or from the material to be cut.

5. The system or arrangement of a self-acting feed movement for the supply of blanks or materials to be turned.

6. The use or employment of differential grooved disc and slotted crank lever movement, as described.

7. The peculiar arrangement of scroll pulleys, or differential grooved cylinders, for the purposes described.

Charles Seely, of Heighington, Lincoln, merchant. *For improvements in grinding wheat and other grain.* Patent dated April 5, 1850.

These improvements consist in introducing a stream of air between mill-stones, which is effected by means of horns connected to an air chamber in the eye of the runner stone, and enclosed in a casing. The lips of the horns have affixed to them fans, for the more perfect collection of air, and a cylinder for supplying the grain is introduced in the centre of the air chamber. The patentee disclaims the use of horns generally, such having been previously employed, but he claims—

1. The application of fans or blades in combination with horns used for introducing a current of air between mill-stones.

2. The employment of an outer casing in combination with horns used for introducing a current of air between mill-stones.

3. The causing of horns used for the above purpose to be connected with a chamber in the eye of the mill-stone, as described.

Ebenezer G. Pomeroy, of Cincinnati, United States of America. *For a new and useful process of coating iron and other metals with copper and other metallic substances.* Patent dated March 7, 1850.

In order to prepare the iron or other metal for the dipping process, Mr. Pomeroy first cleanses it with dilute sulphuric acid, then dries it over a brisk fire, and envelopes it in a paste or pulp of clay, after which it is a second time dried as before, when it is ready for the finishing operation. In order to carry out this part of the invention, a suitable bath of copper or its alloys is prepared and kept in a state of fluidity. In this the iron is to be immersed for a length of time varying with the size of the article. Thus, sheet iron should be kept in the melted copper only a few seconds—for this reason, that as soon as "impregnated" (coated) it becomes "hot-s. ort," and will break by its own weight; but if carefully handled when cold, it will be tough, and when rolled will present a bright surface equal in appearance to copper or brass. In other cases the time required for coating will depend on the massiveness of the piece immersed, and on its being raised to a temperature at which the copper is in a condition to commence "impregnation." This may be attained by keeping the melted metal at a heat beyond the bare melting point. In all cases the iron should be immersed only so long as it will bear without becoming "hot-short;" and the toughness of the metal will depend on the amount of "impregnation" during the first dip. The immersion may be repeated till the coating is of sufficient thickness. The patentee observes that the usefulness of clay as a coating depends on the ammonia therein contained, which unites with the residual sulphuric acid of the first process, and neutralizes its action on the iron, at the same time preventing oxidation from contact with the atmosphere.

The plates thus "impregnated" are suitable for sheathing ships, roofing, &c.; and iron spikes or bolts for ship-building purposes thus treated, are stated to be, in consequence of their greater strength, preferable to those composed of copper alone; besides which, they are not liable to oxidation—the copper acting as a protection against the gallic acid contained in wood.

Claims.—1. The before-described process of coating or "impregnating" iron or other metals of all useful shapes and forms, with copper or any alloy of which copper forms a part—the said process consisting in cleansing the surface of the iron or other metal with sulphuric or other acid, defending the cleansed surface with a coating of clay or other aluminous earth, drying the same, and then dipping the article so coated into melted copper or alloys of that metal.

2. The employment of clay-paste for the purpose of protecting the surface of the

metal from oxidation during the process of alloying, or coating the metal plates or pieces of metal, as set forth.

WILLIAM GILBERT ELLIOTT, of Blisworth, Northampton, gentleman. *For improvements in the manufacture of bricks, tiles, and pipes and other articles from plastic materials.* (A communication.) Patent dated April 27, 1850.

The novelty of this invention consists in manufacturing bricks, tiles, drain-pipes, window-sills and mantel-pieces, culverts, copings, &c., from clay melted in air or blast furnaces of the ordinary description, but erected for convenience sake as near as possible to the pit whence it is dug, and then, whilst in a state of fluidity or fusion, run direct from the furnace into suitable moulds of iron or other material, as owing to the high degree of temperature at which clay melts, it will not bear to be conveyed in troughs, or ladled into the moulds, as is the case with metal. An endless web is employed for more readily conveying the moulds to and from the discharge vent or opening in the furnace.

The articles thus formed are ready for use when cold; care must, however, be taken to protect them from damp during the time they are cooling.

GEORGE HENRY PHIPPS, of Park-road, Stockwell, Surrey, engineer. *For improvements in propelling vessels.* Patent dated April 5, 1850.

The improvements claimed under this specification are

1. The forming of sterns to vessels to be propelled by a screw or screws so that the upper portion of the stern is made to overhang or project over the lower portion whereby all horizontal lines from the bottom of the vessel to the level of the top of propeller, will converge to a vertical line in advance thereof, and all horizontal lines above the level of the top of the propeller will converge to a vertical line further aft than the extremity of the same.

The advantages assumed to be derived from this construction of stern (which may be familiarly illustrated by supposing a vessel to be cut in two longitudinally and horizontally, and the upper portion slid along so as to project beyond the lower half) are:—1. To obtain the smallest amount of resistance from minus pressure at the stern, hence securing more solid water for the screw or screws to act in, as regards all the water on a level therewith. 2. To obtain a clear run of all the water above the level of the propeller to the rudder. And 3. To obtain as small an abstraction as possible from the buoyancy of the vessel in consequence of diminished displacement.

2. The power of elevating or depressing screw propellers by any means whatsoever, so as to work the screw at any required altitude.

The machinery employed for working the propeller is in this, as in the former instance, that of ordinary construction; but to allow of the shaft being elevated, it is united to the driving power by a universal joint, and the elevation is effected by means of a screw turned from the deck of the vessel, and attached by slings to a collar on the propeller shaft.

JONATHAN CHARLES GOODALL, of Great College-street, Camden Town, Middlesex, card-maker. *For improvements in machinery for cutting paper.* Patent dated April 5, 1850.

These improvements consist in having the knife or cutter fixed, and the table moveable, and supported on a cranked axis. By turning a handle, connected by suitable gearing to this axis, the table is raised, and carries the paper, piled against an adjustable guide-piece, and kept down by the pressure of a bar with rods and weighted levers at the ends, up against the knife, which, after cutting, is received on a surface of gutta percha fitted into a groove made for it in the table,

Claims.—1. The arrangement of machinery for cutting paper, wherein the table is raised and the knife or cutting instrument stationary.

2. The means described for pressing paper on the table.

3. The application of gutta percha on the table, for receiving the edge of the knife or cutter.

JAMES SAMUEL, of Willoughby House, Middlesex, civil engineer. *For certain improvements in the construction of railways and steam engines, and in steam-engine machinery.* Patent dated April 5, 1850.

Of the principal portions of this invention we shall give a full description, with engravings, in an early Number.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Charles Bury, of Salford, Lancaster, manager, for certain improvements in machinery or apparatus for preparing and spinning, doubling or twisting silk waste, cotton, wool, flax, or other fibrous substances. October 10; six months.

Charles Bury, of Salford, Lancaster, manager, for certain improvements in machinery or apparatus for cleaning, spinning, doubling, and throwing raw silk. October 10; six months.

Robert Beart, of Godmanchester, for improvements in the manufacture of bricks and tiles. October 10; six months.

John Scott Russell, of Great George-street, Westminster, engineer, for improvements in the construction of ships or vessels propelled by paddle-wheels, with a view to better arming the same. October 10; six months.

William Wood, of Over Darwin, Lancashire, carpet manufacturer, for improvements in the manufacture of carpets and other fabrics. October 10; six months.

William Henry Ritchie, of Kennington, Surrey, gentleman, for certain improvements in machinery for preparing and carding fibrous substances. (Being a communication.) October 10; six months.

William Edward Newton, of Chancery-lane, engineer, for improvements in manufacturing yarns. (Being a communication.) October 10; six months.

James Hamilton Browne, of the Reform Club, Pall-Mall, Esq., for improvements in the separation and disinfection of fecal matters, and in the apparatus employed therein. (Being a communication.) October 10; six months.

William Francis Fernihough, of London, engineer, for improvements in locomotive and other steam engines, and improvements in obtaining motive power. October 10; six months.

Whiting Hayden, of Windham, Connecticut, United States of America, for an improved regulator or apparatus for regulating the draught of the sliver on the machine, termed the "drawing frame." October 10; six months.

Ardolf Frederick Gurlt, of Manchester, gentleman, for an improved method of extracting silver from argentiferous minerals. October 10; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Oct. 1	2456	Thomas Thompson	Commander, Royal Navy	Safety-plug for boats and vessels.
"	2457	George Aldred	Primrose-street, Bishopsgate	Plate mortice nut for a looking-glass.
"	2458	Walter Raymond	Dalston	Life raft.
2	2459	Frederick Clowes	Birmingham	Self-adjusting vertebral brace.
"	2460	Samuel Augustus Hayes	Strand	Apparatus for fractures of the lower extremities.
3	2461	Thomas Key	Charing-cross	Regimental cased clarionet.
4	2462	Clayton Shuttleworth and Co.	Stamp End Works, Lincoln	Combined threshing, shaking, and riddling machine.
"	2463	H. Kilby and W. Harris	Cheltenham	Portable hot-house.
"	2464	John George Taylor	Great St. Thomas Apostle	Self-securing spring for pins, brooches, and ornaments.
"	2465	Allen and Moore	Birmingham	Match-box lid.
"	2466	Mortiboy and Herbert	Newman-street, Oxford-street	Clasp-fastener for bracelets, chains, and other articles of jewellery and dress.
5	2467	John Cartwright	Newton-wood, Chester	Steam boiler.
"	2468	George Harrows	Old Bond-street	Railway-travelling trunk—"The Panelasticon."
7	2469	George Boulton	Great Dover-street, Borough	Safety pin.
8	2470	Roger Brown	Sheffield	Magnetic lightning conductor.
"	2471	Elkington and Co.	Birmingham	Fountain.
"	2472	W. Culverwell	Charlotte-street, Blackfriars-road	Portable doestic vapour bath.
"	2473	Fox, Henderson, and Co.	Birmingham; and Spring-gardens, London	Luffer for a ventilator.
"	2474	Miall, Marshall, and Co.	Ingram-court, Fenchurch-street.	Duplex flanged pipe joints.
"	2475	William Chapman	Johnson-street, Clonmel, Tipperary	Grain crusher, and regulating feed, for facilitating the grinding of meal and flour.
9	2476	William Lowe	Birmingham	Bolt.

CONTENTS OF THIS NUMBER.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1419.] SATURDAY, OCTOBER 19, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

DR. HAYCRAFT'S PRIMING-PREVENTION APPARATUS.

Fig. 1.

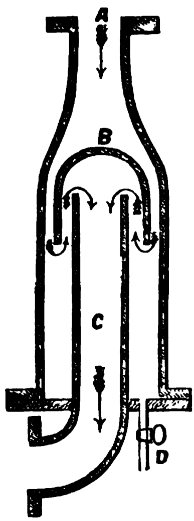


Fig. 4.

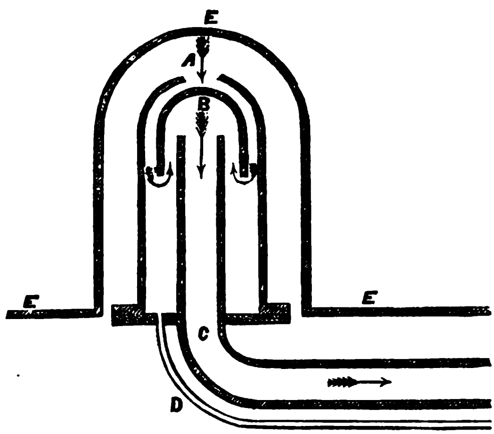


Fig. 2.

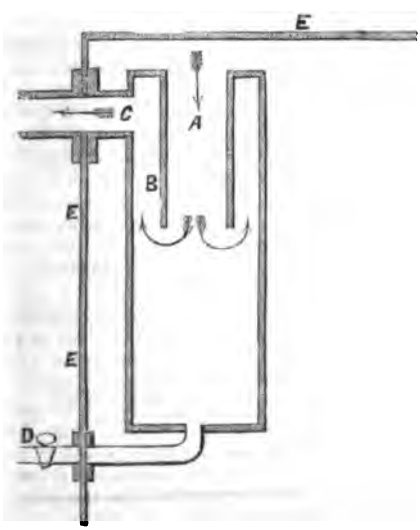
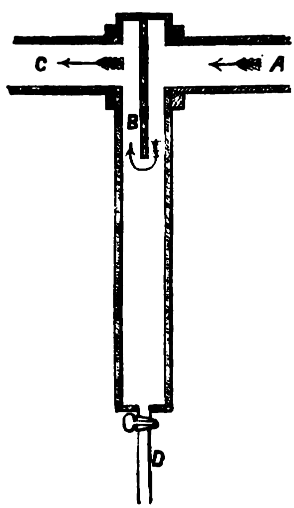


Fig. 3.



ON ANHYDROUS STEAM, AND THE PREVENTION OF BOILER EXPLOSIONS. BY DR. HAYCRAFT, GREENWICH.

(Concluded from page 291.)

These quantities, however, must not be considered as indicating the whole of the saving which would be produced by the application of anhydrous steam to engines in general: for this reason, that the engine on which the experiments were performed was so arranged as to produce the best possible effect without its use; for in addition to the engine being made by a first-rate engineer, there was abundant steam room in the boiler, the steam pipe was large and inclined downwards to the boiler, besides which the steam was applied to the jacket, not as is usually done, but in the same way as in the Cornish engines, or rather in a somewhat superior manner, as the cylinder cover was covered with steam, and every pains taken to ensure the perfect action of the old method. On the other hand, in locomotive, or even in marine engines, where there is a confined steam space,—and especially in locomotives, in which an enormous power is forced from small boilers,—there must be a very serious loss by the use of steam hydrated in a very high degree. The value of anhydrous steam in these cases can hardly be sufficiently appreciated.

The makers of locomotives appear to be aware of this in some degree, as in the newest engines the steam room is increased by means of large steam chests, &c., as much as the confined space will admit: but after all is done, the almost ruinous expense of repairing these machines, attests the evil effects arising from the present system. Capital would be well engaged in carrying out this plan with respect to locomotives and marine engines.

In consequence of these experiments, which were repeated in a variety of ways, a recommendation was made to apply the apparatus at the Government expense. This was about being done when its progress was inspected, in consequence of new regulations respecting experimental matters.

Another remarkable fact was observed in these experiments; namely, that with the apparatus, that is with the use of anhydrous steam, the engine would carry above one-fourth more load, or, in carrying the same load, on expansion being put into action, there appeared a saving of 59 per cent. compared with the engine working in the ordinary way.

That steam should undergo no expansion by an increase of its temperature appears somewhat anomalous; yet this may be considered as one of the interposited laws of nature, somewhat analogous to the increase of volume in water by the abstraction of caloric between the temperature of 40° and 32°. If it were not for this law, lakes and rivers would be frozen from the bottom, and a constant winter would reign even in the temperate regions; an equally good reason, or final cause, may be given why the vapour of water should not expand by an increase of temperature; namely, that earthquakes and other convulsions of nature, being probably caused by sudden evolutions of aqueous vapour occasioned by subterraneous fires; had the usual law of expansion by heat held place, and, much more, had the aqueous vapour been converted into "stame," the very earth would be shattered to pieces, no rocks nor hills could withstand its force, and the world would become one mighty ruin.

There is one more interposited law of nature, which is, perhaps, as important as the two I have mentioned. In some experiments which the Royal Society of Edinburgh did me the honour of publishing, it has been shown that the air of expiration in animals contains very much less combined caloric than the air of inspiration, chiefly in consequence of the vapour of water combined with it. From this it appears that the process of evaporation which continually takes place in the lungs, instead of having a cooling effect, as in every other case, becomes actually a heating process. It appears, therefore, that had this interposited law not had existence, animal heat could not be sustained, and should this law be suspended for one hour, the consumption of carbon in the system being insufficient to maintain the animal heat, the whole animal race would sink into torpidity and death. That evaporation of

water should, under any circumstances, occasion an evolution of caloric, is almost incredible, but not more so than the two interposited laws I have just mentioned.

Mr. Frost and myself, although we vary somewhat, agree in the more essential points. There is even a striking accordance between us. He finds by experiment that an addition of 4° doubles the volume, and I have shown that in an 18-horses power engine, the power is nearly doubled,—that is 46 per cent. is added by a temperature which certainly did not exceed 4° in the cylinder. He also states, that by an addition of 440 lbs. the volume of steam heated out of contact with water is increased nearly tenfold; and I have shown that in a small engine, by the application of steam of 500 lbs., the effect of the steam was increased more than tenfold. The advantage of heating the steam is the same on both hypotheses. We differ chiefly in theory. Mr. Frost supposes that steam being subjected to a higher temperature, is converted into "stame," while I believe that "stame" is nothing else but pure anhydrous steam. In practice we also agree, excepting that he proposes the very means which I used many years ago, and which were abandoned, not because they were inefficient but because they have been superseded by more useful and practical methods.

As to the amount of advantage to be derived from the use of anhydrous steam, it will vary in each case. It would be imprudent to expect too great things, but I have shown that in a very small engine the saving was 90 per cent.; and that in an 18-horses power with abundant steam room, it would amount to 46 per cent. It is also probable that in the same kind of engine the saving will be inversely the size of the engine, in some proportions or other. Thus the diameter of the small engine compared with the other was 1 : 6, and the saving was 90 : 46—then if we suppose a 12-feet cylinder which would be six times the diameter of the 18 horses power, the saving might be lessened in the same proportion, the 90 : 46 :: 46 : 23⅓ per cent. In actual practice the saving will be very much greater, for the reasons I have before stated. I have shown in the Appendix that the proper quantity of good coal for condensing low-pressure engines is 3·29 lbs., per horses power per hour, while in practice the consumption is not less than 6 lbs. and up to 18 lbs. I have shown also that the Cornish engine, with all its vaunted powers, instead of consuming 1·47 lbs. per horses power, consumes 2·21 lbs.,—being a loss of 33 per cent: while on the other hand I have shown that a low-pressure engine driving only one pair of millstones and with the siccator, &c., consumes 3·6 lbs., while by measurement it should consume 3·29 lbs.,—being a loss of 8·7 per cent. only. Compare this with other engines of this class, which consume from 46 to 80 per cent. more than the proper quantity.

An anhydrous cylinder is also especially favourable for working the steam expansively. The cylinder when sustained above the condensing point allows of the full effect of the expansion according to the theory of the hyperbolic curve.

I will make a few remarks on the use of the priming box, which so materially assists in drying the steam. I have even found it very useful when used by itself. It is applied to one of the river steamers, and by repeated experiments I hava found that it effected a saving of 7 per cent. The engineer told me that with this apparatus he could drive the engines for a whole week without blowing out the boiler, and without priming the engine, while without it it was necessary to blow out twice or thrice weekly. This little apparatus which can be applied to any engine at a small expense, deserves the especial notice of engineers. It would soon save itself by the protection it would give the cylinder, piston, and slides from dirt and scales from the boiler.

Prevention of Boiler Explosions.

We now come to the very important subject of boiler explosions; Mr. Frost has so ably explained the most frequent causes of them, that little more need be said on the subject. The fact is, that they take place not when the steam is at its full tension, as when, for example, the engine stops for a time; but after the engines have started again, and made some revolutions, and the tension of the steam is suddenly reduced. The cases of explosion usually happen when the water supply has been

neglected, and a portion of the boiler not covered by the water becomes red hot. The explanation may be as follows: The engine having stopped some time, has become cold, then agreeable to the principles above stated, the steam on entering the cold cylinder is rapidly condensed during the several revolutions; a large quantity of steam is rapidily drawn from the boiler, the water therein being of a high temperature, and being also suddenly relieved from a considerable portion of the steam pressure, boils rapidly, throwing up priming water, which coming into contact with the red hot plates of the boiler, a sudden evolution of steam takes place, in such quantity as to act like detonated gunpowder; so that no boiler, however strong, can resist its violence. Those who are conversant with the river steamers will have observed that after each stopping, the engines, especially if the boilers are very foul, prime very much; that is, the noise of the ebulition water rushing into the cylinders can be distinctly heard. Now, in such a case, if the water in the boiler happen to be extremely low, there would be the utmost danger of an explosion.

Besides the obvious propriety of keeping the boilers clean and well supplied with water, it will appear quite clear that even should these precautions be omitted from carelessness, the use of anhydrous steam would inevitably secure us from such disasters, for the following reasons; and it is a fortunate circumstance that what was designed merely to save expense should also be the most efficient means of securing our safety.

Should the engines stop for any time, the cylinders being constantly maintained above the condensing point of the steam, the engine on starting would require no more steam than usual; there could be no sudden abstraction of steam from the boiler, and, in short, the whole train of causation, before described, being prevented, no explosion could ever occur. Even a common steam jacket would in some measure diminish the danger. I have never myself heard of any boiler of a steam engine having a jacket, exploding from this cause. This subject really deserves the attention of engineers, as we have it in our power to prevent the greater number by far of these serious accidents.

Jackets have been discarded from most engines, because they have been found to produce but little saving of steam in those engines in which there is but little steam space; so that with the exception of the Cornish engine, steam engines have retrograded, as Mr. Frost says, since the time of Watt.

As a measure of safety in boilers, the use of the priming-box promises great security, because most explosions arise from priming. All boiler explosions, in fact, arising from priming, excepting those few which are occasioned by an undue proportion between the tension of the steam and the strength of the boiler, that is by the boiler being worn out by too long use or from improper construction. This cannot happen but from the most culpable negligence. I have shown above, that by this means, a river steamer could be worked seven days instead of two, without blowing the boiler. The cause of this is, that the apparatus receives the priming on starting the engine after stopping, thus preventing it from entering into the engines. This prevents in a great degree the cooling down of the cylinders, and the consequent great demand for steam, by which the boiler being partly exhausted, the priming rises in great quantities and produces the effects that have been described. This simple apparatus may be applied at a small cost to any steam engine; it occupies a small space, and has, besides the security it affords, the advantage of saving from 7 to 10 per cent. in the fuel. This subject deserves investigation, and should these promises be correct, no engine, and especially no river steamer, where the water is constantly foul, should be unprovided with this apparatus.

The burning of locomotives which so frequently happens, and which is attended with such enormous expense and inconvenience, arises also from priming. It is reported in the *Observer* that six engines belonging to the Eastern Counties Railway were burnt between the 18th and the 21st of August last. The immediate cause of this mischief is a defficiency of water. But this deficiency of water is occasioned by the great quantity of priming which takes place in the engines whenever the boilers become foul. This is far more probable than that the engine-drivers neglected to provide the usual quantity of water; and it is highly probable that in these cases the

boilers had been tampered with. An efficient priming-box would have prevented these accidents.

It would certainly be desirable to construct steam engines in such a way that safety depends as little as possible on the carefulness or negligence of engine drivers and firemen. This security, I believe, is affected by the anhydrous system.

As a summary of what I have stated, it has been shown that "stame" is nothing else than pure or anhydrous steam; that steam engines consume by measurement from one third too much, as in the case of Cornish engines, to near six times the proper quantity of coals; that this loss is occasioned by the use of hydrated steam, and by the coldness which it occasions in the cylinder; that this coldness is caused by a constant evaporation which takes place within; and also that this evaporation is prevented by a steam jacket containing steam which shall sustain the temperature of the cylinder slightly above the condensing point, together with the use of anhydrous steam, and this may be accomplished with a great saving of fuel.

That boiler explosions arise chiefly from priming, which takes place in consequence of the cylinder becoming cold after stopping—together with a deficiency of water in the boiler, which thereby becomes red hot; that this priming still farther cools down the cylinder causing a still greater exhaustion of steam, and consequently a more violent ebullition, which, acting on the red-hot boiler plates, causes such a sudden and copious production of steam, that the explosion takes place; that a heated cylinder, together with a priming-box, &c., would afford perfect security against these accidents, even should the boiler become foul or deficient in water. That an efficient priming-box alone would afford a good security against boiler explosions; and, lastly, that the burning of locomotive engines arises from the same cause, and would be prevented by the same means.

There are many points concerning priming, which had I space might be pointed out; such as the priming of sea-going steamers on entering fresh water, which arises from the high temperature the water acquires in consequence of its impregnation with salt. This high temperature converts the fresh water supplied into the boiler into steam too suddenly, which is also not unattended with danger.

I will just mention one fact which, although apparently insignificant, shows in a striking manner the effect that an admission of a very small quantity of water has in cooling down the cylinder. While experimenting on the engine referred to, I blew the slide case, and then remarked the effect produced on the hot-well. The difference of temperature previously was 20°, but after blowing the slide case the temperature fell 3°, showing a saving of 15 per cent. It was, to be sure, a long T slide, which would increase the quantity of the water of condensation. This shows that apparently trivial circumstances deserve attention. I am aware of the natural aversion which engineers have, in common with others, to new plans designed for the improvement of their own art; yet I trust some will be found who will investigate these matters, and regard their noble profession not so exclusively as men of business as to prevent them from promoting whatever may contribute to the purposes of general utility.

Fig. 1 is a priming tube or separator: it forms a part of the steam pipe, and is placed close to the engine, or else receives the steam before it enters the siccator. The steam enters at A, follows the direction of the arrows on the outside of B, which is an inverted cup-shaped cylinder, suspended by strips to the external chamber. At the lower curved arrows the water is separated and falls to the bottom; the steam then passes into the engine or siccator. D is a stop-cock to blow the apparatus.

Fig. 2. The same description and letters apply to fig. 2. This priming-box may be placed within the boiler, and is designed especially for river steamers, or wherever the water is very foul. E, E, E, a portion of the boiler.

Fig. 3 is a cheaper form of the apparatus. It consists of a cast-iron box in the form of a parallelogram. The water is separated by passing under a diaphragm B, and makes its exit at C. D is the blow-cock. This form is useful where the steam pipe runs in a horizontal direction.

Fig. 4 is a modification of fig. 1, and is suited for insertion in the dome of a loco-

motive: this and fig. 2 require the addition of fig. 1 or 3 to receive the condensation of the steam pipe. E, E, E is the dome.

Appendix.

A list of different steam engines that have come under my observation, with the quantity of coals consumed per horse power per hour.

	lbs.
Cornish engine at Deptford, see below	2·21
Wolf's engines at Greenwich, ditto	3·
High and low-pressure engines at Greenwich, 40-horses power	6·
Average of five pair marine engines (Tredgold) nominal	10·3
Corn-mill at Deptford, 12-horses power, low pressure	14·0
Messrs. Johnson and Berry's engine at Birmingham, 8-horses power nominal	16·
Mr. Smith's engine, almost new, at Bermondsey, 5-horses power nominal	18·88

Calculation to show the quantity of Coals which should be consumed by Steam Engines per Horse Power per Hour:

Note.—The capacity of steam, of all densities, is supposed to be constant, that is, as the density. Also that a horse power is equal to 33,000 lbs. raised one foot in the minute.

One cubic inch of water = 1 cubic foot of steam (Watt), of the elasticity of 15 lbs. on the square inch = 144 × 15 lbs. = 2160 lbs., which would be lifted during its formation one foot high: and if this be done in one minute of time, 2160 : 33,000 :: 1 : 15·27 cubic inches of water required in one minute, or 916·2 cubic inches required in one hour = (1 cubic foot = 62·5 lbs.) 33 lbs., to which add one-fifth for friction and loss, or 6·6 lbs., total water 39·6 lbs.; and if we allow 1 lb. of coals to evaporate 8·4 water (Tredgold) the consumption of coals will be

$$\frac{39{\cdot}6}{8{\cdot}4},$$

or 4·71 lbs. per horse power per hour.

But if the steam work expansively, this quantity is divided by the number according to Watt's Table, which corresponds to the degree of expansion. Thus, in Cornish engines, the steam is stopped at one-eighth, and by the Table the performance is multiplied by 3·2; therefore the consumption of coals for these engines should be

$$\frac{4{\cdot}71}{3{\cdot}2} = 1{\cdot}47 \text{ lbs.}$$

per horses power per hour.

Again; in Wolf's engine, in which the expansion cylinder is four times the size of the other, and therefore, *pro tanto*, the steam is stopped at one-fifth. This, by the Table, multiplies the performance by 2·6; therefore, take the above constant quantity 4·71 as before, and

$$\frac{4{\cdot}71}{2{\cdot}6} = 1{\cdot}81 \text{ lbs.},$$

the quantity which should be consumed by these engines; but they consume 3 lbs. per horse power per hour, and some of them twice as much.

Also in low-pressure engines, which use a slide valve. The slide stops the steam at two-thirds, which multiplies the performance by 1·43; then

$$\frac{4{\cdot}71}{1{\cdot}43} = 3{\cdot}29 \text{ lbs.},$$

which is the proper consumption for these engines; but they actually consume from 6 lbs. to nearly 19 lbs.

Calculation to show the consumption of Coals in the Cornish Engine at Deptford, with the steam stopping at one-eighth, and using the best Coals.

Engine lifts 84,000,000 lbs. of water one foot high by the consumption of 94 lbs. of coals. If we suppose this to be done in one minute of time, the number of the horses power would be

$$\frac{84,000,000}{33,000}=2545;$$

and if in one hour,

$$\frac{2545}{60}=42\cdot45, \text{ and } \frac{94 \text{ lbs.}}{42\cdot45}=2\cdot21 \text{ lbs.},$$

or the consumption of coals per horse power per hour; but the proper quantity, as we have stated above, is 1·47 lbs.; being a loss of exactly one-third.

The only engine in which the siccator, &c., have been applied in an imperfect manner, and acting under disadvantageous circumstances, consumes 3·6 lbs., the proper quantity being, as above, 3·29 lbs., which is a loss of only 8·7 per cent. This is the nearest approximation of any engine in existence to the true theory, and far surpassing the Cornish engines in effect, especially considering the vast difference in their size, pressure of steam, and the rate of expansion.

To exceed the theory seems not to be very probable, unless it should turn out—and the possibility of which I admit—that Mr. Frost's notions concerning the expansion of steam are correct. But without this, the room for improvement is very great, so much so that it may be considered that the steam engine is still in its infancy. It requires only the due application of capital to produce effects as yet unthought of.

In addition to what I have stated, there are certain improvements in the management of furnaces exceedingly simple. At some future opportunity, it is my intention to communicate my ideas on the subject by means of this widely-circulated Magazine.

I am, Sir, yours, &c.,
W. T. HAYCRAFT, M.D., &c.

PHILLIPS'S FIRE ANNIHILATOR—PRACTICE v. THEORY.

Sir,—In your Magazine of Dec. 22, 1849, you favoured me by inserting some remarks concerning Mr. Phillips's invention; these remarks were written prior to any experiments excepting those at Vauxhall; but now that Government have given him a house on fire at Woolwich to annihilate with his vapour,—and from some cause or other he allowed it to be burnt down,—will you allow me from this, and also from Mr. Phillips's *own* experiments on his *own house* at Battersea, on the 8th instant, to again encroach on your valuable Magazine, in order that your readers, and the public generally, may not be misled by the flattering reports which have appeared in the newspapers lately (not that many of your readers would trust the report of a penny-a-liner on any scientific question); but in order that having read their side of the case, they may now see the other with more minute particulars, and thus be enabled to give Mr. Phillips's invention its due.

In doing this it will be necessary to give the exact state of affairs at Battersea, and if Mr. Phillips were unable to extinguish *his own fire* with himself and machines on the spot fully prepared, surely the inference to be drawn is, that were a fire to occur *accidentally* and unlooked-for (as most fires do), there would not be the remotest chance of extinguishing it.

The house, or rather cottage, two stories high, was built of brick with a wooden staircase built in the wall; the windows were hung with calico instead of being glazed, pieces of wood were knocked together to imitate furniture, and in each room some shavings were placed. At a signal, the shavings were fired in several different places at the same time; and to persons unaccustomed to such sights, the whole house would naturally appear on fire; but if we consider the means employed to extinguish it, we shall see that such was not the case; outside two powerful machines, on wheels, with hose attached, were charged, and the vapour forced into the building; this of course nullified to a certain extent what flame it came in contact with; but when on looking more closely we see men running about inside, and find that ten or a dozen hand machines had been used inside the house, we come to consider; first, what sort of a fire could it have been to allow men inside? where was the large body of smoke, which, if the house had been properly alight would have suffocated them? Secondly, if it require two powerful machines outside, and a dozen smaller hand machines inside, to annihilate a fire in a cottage,

where men can move about, how many would be needed to extinguish a fire when no one could go within several feet. The fact is, some shavings were fired in each room and charred some of the wainscoating near; but except in one instance (where the fire communicated by a small opening), the fires were totally distinct from each other. I may here add, that two or three dozen buckets of water had to be used to put out the burning embers; why, in ten minutes a seven-inch fire engine would have put 900 gallons inside, and washed the house away nearly.

If, Sir, you will spare me the space and your valuable time, I should like to consider the utility of this invention (which has been so improperly pushed before the public), when applied to the different classes of fires, for which all machines for extinguishing fires ought to be more or less suited.

First. As to small fires, *i. e.*, fires discovered at the commencement; suppose a servant going up-stairs finds the bed-curtains on fire, and Mr. Phillips's annihilator is in the house (in the hall he proposes to keep it), if she were not unnerved, nothing would be more easy than to pull them down, or throw a blanket over them; but she runs down-stairs, alarms the house, and, being unnerved, of course leaves the door open, and before the other inmates can tell what is the matter, and where, the bed and furniture are fanned by the draught, and, in fact, the room is thoroughly on fire, and before the annihilator can be brought to bear, the smoke from the feathers and furniture is so overpowering to any one not well accustomed to it, that they would endeavour to get near the door of the room in vain. Or suppose a strong smell of burning is felt in a warehouse, and after searching, a little smoke is discovered oozing through the flooring round the hearth or near some flue; the flooring must be cut away and the annihilator used. It will extinguish flame; but here is a large mass of red heat—timber gradually reduced perhaps for years to a state of touch-wood, fired by some stray spark from the stove or chimney; the annihilator therefore fails here, and the increased draught from opening the flooring may be productive of serious consequences. In such cases, it is scarcely possible for the inmates to extinguish it, as the fire generally lays under beams, &c., where, unless a very great quantity of water is thrown, so as to saturate all the flooring and joisting near (which would do incalculable damage to the goods in the room below), they cannot reach it: here the firemen should always be called, as they are not only thoroughly used to such jobs, but they carry a small force-pump on purpose, which they work from a bucket, and thus apply the water to the part actually on fire with scarcely any damage by water. These force-pumps cost not nearly so much as the smallest annihilators, and the expense for each charging is the value of a bucket of water—not five shillings per case. These two examples are of every-day occurrence, and a fire generally commences in some small beginning of this kind. It seems to me that presence of mind is all that is wanted in the one case, and a little water applied with skill in the other.

Second. As to large fires in warehouses, factories, &c., I put the question simply as before: If it take two largest size annihilators, and a dozen smaller ones, to annihilate five or six bundles of shavings, how many will be required to extinguish a sugar-house, a cotton factory, or a Liverpool warehouse? If Mr. Phillips were to state the proportionate amount, according to Cocker, I think he would find himself getting into figures where algebra might be useful.

Third. As to its utility in preventing the spread of fire from roof to roof, I made an inquiry on this head in your Magazine of December 22, 1849, but as the invention has been so puffed up lately, will you excuse my repeating it; and if you will allow me to say all now, I will not again occupy your valuable space by again writing on this gasy invention. When the water is applied from the common fire engine, the materials become saturated and damp, but the annihilator will only put out the actual flame, so that the burning flakes falling on a building thoroughly dry from the heat of the fire adjoining, would not be prevented from firing that building. Besides, suppose that the annihilator did as much good as water, imagine the expense of keeping even one machine constantly at work for five or six hours in the open air, with the wind blowing the gas about anywhere; one of

the smallest charges costs 5s., and lasts about four minutes.

Fourth. And, lastly, as to ships; here, if anywhere, the annihilator ought to succeed, because, if the cargo took fire, the hold could be made nearly air-tight in a few seconds. The nose of the annihilator might be thrust down a hole cut in the deck; and if the captain carried a few pounds sterling of composition with him, the oxygen might be so completely nullified as to prevent even the red heat from existing.

Since the total failure of the experiments lately made, allow me to contradict my former statements last December concerning distilleries, &c., by saying that since it requires so much gas to put out a few shavings, I do not think it can be found serviceable even in distilleries or in buildings of any kind; but would do more harm than good, by causing the inmates to put a false confidence in it, and thus neglect the other and effectual means; viz., the common fire-engine.

I am, Sir, yours, &c.,
JOHN PRACTICE.

London, October 14, 1850.

RISE AND PROGRESS OF AN "ORIGINAL IDEA."

Sir,—Taking up the subject of "original ideas," mentioned by your correspondent "C. E.," page 250, I beg to state, that in the year 1839, as I was sitting in my parlour, I saw a large cat walk along the slender horizontal bough of a young beech-tree, and from the end pass to the like bough of another tree in the plantation. I was surprised at the very small deflection of the bough, and thought these boughs formed a complete suspension bridge. I went and examined the tree, and tested the bough as to the weight it would bear, and considered how the bough was supported, and how I could best make such a bough artificially. The bough, as we all know, thickens and has firm hold of the bole of the tree, and the bole firm hold of the ground by its wide-spread roots. It immediately occurred to me, that to obtain *breadth* for a road without extra weight, I must make the bough *hollow*, and like a telescope taper, with either a passage through it or on it. But what would be the best—I mean the most *economical* mode of imitating the firm ground roots of the tree? This I found would be best effected by passing a *rod* from the light end of the bough-tube to the upper part of the bole, and thence pinning it to the ground on the other side; and by often repeating this process towards the thick end of the bough-tube, I found I could obtain a rigid gangway, and sustain it by a trellis of rods, with less metal than what constituted the sides and top of the tube and joinings to the bole.

This, I think, would be found to be the case with the Great Britannia Tube if tried, which, though astonishing as a bold, novel, and clever construction, I believe involves a vast waste of iron and labour in proportion to the weight it will carry, and that Mr. Stephenson's "original idea" of hanging in chains (or better in rods) would have been much the least expensive, though not so novel.

Now my "original idea" was a tube, but the substantial invention, and one to be patented, I consider resolved into a platform gradually suspended by a tapering trellis of rods.

I think this was mentioned in your pages seven years ago.

I am, Sir, yours, &c.,
SAXULA.

October 14, 1850.

COMMON SENSE VINDICATED AGAINST THE PRETENSIONS OF MATHEMATICAL SCIENCE.

Sir,—Having already appeared in your pages (vol. xlix. pp., 422-3,) as an advocate of common sense, I feel called upon to make one or two remarks upon a portion of the "Geometrical Notes" of your able correspondent Professor Davies, which appeared in your last Number.

I wish, however, not to address myself specially to the "Notes" referred to: to do so would be both unfair to their author—because the remarks which have attracted my attention have nothing to do with his general purpose—and dangerous to myself, seeing that I have only "common sense" and "a few facts," to oppose to his heavy battery of scientific methods. I wish only so far as the "Notes" are concerned to appeal against the sweeping denunciation which he has fulminated against such as myself, who think that "a few facts," well reasoned upon by common sense, may be as really

valuable, and perhaps tend as much to the increase of human knowledge, and the progress of society, as any quantity of abstract science. On this general idea, I wish to ground the few observations which I am about to make. I may premise, that although I may differ with Mr. Davies and other scientific men on the point which I have stated, yet that I consider it to be only a specific difference; a wider generalisation will include both their views and my own.

Let it be asked, What is either mathematical, or logical science? The answer, as I believe, must be,—It is *the result of an attempt to reduce common sense to rules.*

In one word, it is *method*—a method of thinking, or of recording thought.

The common sense of the present time admits this, and is thankful to science for what it has done in preserving the results of the common sense of the past. But it cannot concede to science the power of absolutism. Neither in the past nor in the present, has any one mind or conjunction of minds had power to promulgate a law for all others, and say "*thus* shall ye think for the evolution of truth, and not *otherwise*."

The point that I would contend for is this:—that there may be other methods of thought, not recognised as scientific, which may produce results equally satisfactory with those which are so characterised.

Every man may have, and doubtless has, his own method. I have my own, but I freely admit that another may have a better method than mine; then, if he have—he has a better implement than I have, and ought to produce better work. Let us judge of things by their fruits, and inquire how the *facts* really stand. Have the greatest discoveries been made by men of science, or by non-scientific persons? Leaving astronomical discovery out of the question, I have no hesitation in asserting that the balance is clearly against science.

Inventors generally have not been men of great attainments in abstract science, but they ought to have been so, if there be so much value in scientific method as some would maintain.

Yet can it be asserted that they had no method at all? Had Arkwright no method—or Newcomen—or Trevithick? And how long is it since chemistry scraped acquaintance with mathematics?

The fact appears to me to stand thus,—That which is called the inventive faculty is nothing else than the *perception of relation* among given facts. This perception gives rise to the idea of fitness—the fitness of a certain thing or things, employed in a certain manner, for a certain purpose.

In reference to abstract ideas—this is the "*philosophy* of just inference," or logic: in reference to number, or quantity, it is "mathematical *science*"—but in reference to things of mere practical utility it is the "rule of thumb."

This unjust distinction arises from the attempt to separate a single mental process into different parts, instead of regarding it as one process applied to different subjects. No one can deny the usefulness of logical and mathematical science; but it must at the same time be admitted that many merely practical men make use of all the fundamental truths of those sciences without even knowing them to be such: like the person in one of Molière's comedies, who had talked prose all his life without being aware of it. They use them because they find them where science found them, in common sense.

Thus it will be seen that I have no quarrel with science, but otherwise: I would only assign to it the "*ex post facto*" position, which is its true one. Let it be employed as an accessory, not as a principal. When the thing has been thought, or done, let science record the process, and thus facilitate its repetition. To deduce formulæ from experiment is its legitimate use, although even in this, as regards physics, its value is frequently uncertain: the variation of a single physical condition, may upset the most logical deduction, or the most accurate computation.

I have endeavoured to show that the fundamental mental process is the same, whether it be applied to science, so called, or to science not so called; and that in no case does any one who uses orderly and consecutive thought for a specific purpose do so without some "method." It is obvious that he cannot. And if a person without any knowledge of abstract science, as such, arrive at the same conclusions as another may do by scientific method, why should any

particular preference be shown to the latter rather than to the former, and why should they not be considered equally "scientific," though different? The appeal in both cases, as in every similar case, is to "common sense,"—and in her hands I am content to leave it.

I am, Sir, yours truly

JAMES ROCK, JUN.

Hastings, October 7, 1850.

WHAT IS STEAM?—WHAT VAPOUR?

Sir,—Your correspondent, Mr. Mac Gregor, requests, in your last Number, that some of your correspondents would give a good definition of steam as distinguished from watery vapour. When generated in quantities steam is invisible, watery vapour is visible. Steam generated under a pressure less than that of the atmosphere, like steam generated under a greater pressure, is invisible, as we have very beautifully exemplified in the boiling of sugar by the vacuum-pan process, which is generally conducted at a temperature of some 20° less than the boiling point of water under the usual atmospheric pressure. If we examine the interior of the vacuum-pan, by the aid of an intense light, or even by the light of the sun shining through the bull's eye, or "pan light," we find the steam generated at that reduced temperature is invisible; all that we can perceive is a general rush of very fine globules of sugar up into the exhaust pipe, and through which many a ton of the best of sugar has been discharged into the common sewers from the large sugar refineries. A complete remedy for this waste has however been lately invented, and put in operation by an enterprising sugar refiner at Bristol.* It is still however true, that watery vapour in a highly attenuated form is invisible, as well as steam,—I allude to the absorption of water by the atmosphere. How far watery vapour in this state of combination differs from steam would form a very interesting, and perhaps beneficial, subject of investigation.

I am, Sir, yours respectfully,

S. B. M.

[Another correspondent, "C. W.," sends us the following quotation from "Dr. Reid's Chemistry," as being likely to throw some light on the subject of Mr. MacGregor's inquiry.]

"Matter is observed at the surface of the globe in four very different forms; namely, in the solid, liquid, gaseous, and vesicular form; earth, water, air, and clouds, present familiar examples of these conditions.

. . . .

"*Gases* are thin and attenuated compared to solids and liquids, and are still more mobile than water and other liquids. Vapours constitute a variety of gases, differing from them, as steam differs from atmospheric air, in so far as the one is condensed by cold into water, while the other is not affected in this manner by any degree of cold to which it has hitherto been exposed.

"*Vesicular vapours* present matters in a peculiar condition, into which many vapours pass, under circumstances which have not hitherto been satisfactorily explained. Clouds present a familiar variety of vesicular vapour.

"A number of substances are capable of appearing in all these forms; as water, which can be frozen into ice, converted into steam by boiling, or made to present the appearance of "vesicular vapour" when the steam is allowed to come in contact with the air."

SIR SAMUEL BENTHAM'S IMPROVED TREENAILS FOR SHIPBUILDING.

Although treenails were among the fastenings for navigable vessels, which formed the subject of a paper in Number 1305 of the *Mechanics' Magazine*, and the treenail of Sir Samuel Bentham's invention was particularly spoken of, yet as that improvement does not seem to have attracted the attention of shipbuilders, it seems desirable that some further particulars on the subject should be stated as they appear in an intended official letter of his to the Admiralty, but which was withheld, as by their Lordship's order he had an opportunity of introducing his treenails in the construction of the fir frigate, the *Minerva*.

The following is an extract from the letter referred to:—

"In the usual mode of fastening plank to the timbers of a ship's side by means of treenails, they are of a cylindrical form, and are of the same diameter throughout their whole length, and are driven through the plank into the timbers, the portion of the treenails remaining in the plank being sometimes only a fifth or sixth of its whole length, scarcely ever more than a fourth; by driving so great a length of cylinder

* Mr. Finzel, whose invention is described in No. 1394, of the *Mec. Mag.*

through the plank its fibres are often injured to so considerable a degree that the treenail cannot have a firm hold of the plank; besides that, the disrupted fibres admit water between them.

"When any force is applied tending to separate the plank from the timbers, no other impediment is presented to the sliding of the plank over the treenail than the friction of its surface against the side of the hole in which it is inserted; but the portion of the treenail in the plank being so small compared to the length of treenail in the timber, resistance to the sliding of the plank over the treenail is only a fourth, fifth, or sixth, of that which prevents it being drawn out of the timber; to obviate this disadvantage in some degree, it is customary to slit the heads of treenails after they are driven, and to fill in the slits with oakum. This precaution is, however, found in practice to be inefficient, for when a newly-built or newly-repaired vessel comes to be caulked, it is always found that the plank has been forced from the timbers, and this to so great a degree, that after the caulkers have finished their work, it is always found necessary to dubb off the projections of the plank that caulking has produced—indeed, it is not uncommon to see whole planks forced in this manner so much from the timbers as to have drawn the treenails an eighth, or even a quarter of an inch within the surface of the plank; so much of plank as is thus dubbed up indicates, of course, that it has been separated to the same amount from the ship's side. Dubbing off the plank is so much waste of wound and workmanship; this in itself is of no material prejudice to the ship; but she is greatly injured by the separation of the plank from the timbers, for the part of the treenail which remains unprotected in the space between the timbers and the plank is exposed to all the sources of corruption which may exist in that interspace. Accordingly, on the repair of a ship this portion of the treenail is generally found to be decayed, and that to a degree that its strength in resisting the forces that tend to make the plank slide over the timbers is often diminished at least by a half.

"The form of the treenails used in the experimental vessels, 1795, obviate the imperfections of ordinary treenails, as was ascertained on every examination of those vessels. When the *Dart*, by special orders of the Admiralty, was examined in 1802, she had then been seven years in active service, and had had several engagements with the enemy; the master shipwright of Deptford Dockyard thus reported of the treenails: 'They kept the planking of the bottom in perfect contact with the timbers notwithstanding the most severe caulking; which the usual mode of treenailing cannot perform.'"

The form of Sir Samuel's treenails was given in No. 1305 of the *Mech. Mag.*, yet it may not be superfluous now to transcribe his short description of them, as laid before the Admiralty in a statement of several of his services; his words were—"The having invented and introduced treenails of an improved shape; that is, of different thicknesses in steps, at different parts of their length, the greatest at the head, the least at the point, and with conical heads." He concluded the article thus:—"These treenails were coming into use at the time I was sent away to Russia."

It must be observed, that little advantage would result from the use of his treenails unless appropriate tools for their formation and insertion were also provided. The tools Sir Samuel invented for these purposes were "guides for boring holes accurately in point of direction; tools for mooting treenails with single and double drifts; augurs for boring single and double drift-holes for ditto; rotary tools for forming the heads and points of treenails; punches for driving treenails, by the intervention of which between the hammer and the treenail the treenail is prevented from splitting, the head is preserved sound, and the treenail is driven much tighter than theretofore."

All of the above-mentioned tools were at one time in use in Portsmouth Dockyard.

M. S. B.

DISTILLATION IN VACUO.

Sir Samuel's Bentham's patent of Jan., 1795 (see *ante*, p. 224), indicates that a vacuum might be advantageously employed in distillation, to which operation it does not seem as yet to have been practically applied. The result of his experiments in 1794, relative to distillation in vacuo, were highly satisfactory; but not so those subsequently made by the chemist in the Inspector-General's Office. This chemist in his experiments (carried on privately) had neglected particulars of importance, and in this and many other instances he proved averse to consultation with his superior, the office of chemist was abolished; and

thus distillation in vacuo has remained at rest. Should it be taken up again, it seems essential that the following observation of Sir Samuel should be attended to, as a disregard of it was the supposed cause of the chemist's failure:

"If a pressure of vapour should be suffered to form itself in the still equal to the pressure of the atmosphere, there would be no use in distilling in vacuo."

In proof of this, Sir Samuel noted that, "If a receiver placed upon the plate of an air pump be exhausted, if water of 100° be then admitted so as to fill two-thirds of the receiver, the vapour rising from this water will fill the receiver, and acquire an expansive force sufficient to raise the receiver from the plate of the air pump."

Sir Samuel's immediate object in causing those experiments to be made, was with a view to the economical procurement at sea of fresh water from salt. He effected this on board the *Arrow*, without the expenditure of more fuel than that required for cooking, as has lately been again so successfully done by Mr. Grant. The sailors destroyed the *Arrow's* cooking apparatus, being delighted with the water as preserved in Sir Samuel's metallic tanks; and it was not thought prudent to controul the men in this whim of theirs. But, as amongst the instructions he furnished to the chemist relative to distillation generally, there may be some items not usually attended to in this operation, whether with or without a vacuum, the following selection of them is at the service of the readers of the *Mechanics' Magazine*:—

"In so far as is hitherto known of evaporation in vacuo, it seems that by distilling in vacuo, so much heat will certainly be saved as is necessary to raise the temperature of the fluid from 96° to 212°. Therefore, supposing a certain quantity of coals were required to make water boil in the air, the temperature of the water being at 60°, three-fourths of those coals would be saved by distilling in vacuo, in as far as the bringing the whole to boil is considered.

"How much heat is carried away by the vapour in vacuo has never been tried. To convert one part of water into vapour in the atmosphere, more than five times as much heat is known to be required as would be necessary to make that one part boil from ice cold. From analogy, no more than the same proportion of heat should be required to form vapour in vacuo: experiment must decide this. In order to determine it fairly, no more heat must be given than just enough to keep the water boiling with sufficient force to supply the condenser with vapour.

"Where the refrigerating power is equal to the power which causes vapour to rise, the surface of the condenser may be equal to the surface of the liquor in the still. But when an equal surface of the condenser cannot cool the vapour as rapidly as it rises from an equal surface of the fluid, the surface of the condenser must be increased. Dr. Darwin's ideas respecting the condensation of vapour* consequent on its expansion should be farther investigated and applied to practice.

"Whether is more cold produced by immersing the condenser in a body of running water, or by covering the condenser with a thin coating stream of water constantly changed, and equally spread over its surface, so as to allow at the same time of evaporation?

"The stills of the natives of the Peninsula of India have their refrigerators cooled by a small stream of water falling over their surface.† This mode has been practised for chemical experiments at home with great success. Perhaps were a current of air in its passage to the fire made to pass over the refrigerator, it might in some cases be advantageous."

M. S. B.

MR. NASMYTH'S OIL TEST.

In all the contrivances which have been proposed as oil tests, a most important element has been left out, viz., *time;* inasmuch as the evil which is experienced from the use of a bad quality of oil is only developed after the lapse of several days, when, by the action of the oil upon the metal with which it is in contact, together with the action of the air, such oils become viscid, and begin to clog instead of facilitating the movements of the parts of the machinery it was intended to lubricate.

In the more delicate descriptions of machinery, such as chronometers, watches, clocks, &c., such a defect as the thickening of the oil by lapse of time is a most serious

* See *Philosophical Transactions.*
† See *Asiatic Researches.*

evil; and in examining into the comparative fitness of certain oils for such applications, if we do not include *time* as an element in our examination, we shall be led to form most false conclusions, inasmuch as it is the case that for the first day or two some kinds of oil (linseed oil for example) perform the lubricating duty very well; but at the end of the second or third day they become so thick and viscid as to entirely arrest the motion of the machinery.

The most valuable quality in an oil intended for the lubrication of machinery is *permanent fluidity*. That oil which will for the greatest length of time remain fluid in contact with the iron or brass is, without doubt, the most useful for the purpose. Hence, as before said, the necessity of including the element of *time* in any experiment on the comparative value of such oils.

Some idea may be formed of the importance of having the means of arriving at correct conclusions on this subject, when we know that in some spinning establishments there are upwards of 50,000 spindles in motion at the rate of 4000 or 5000 revolutions per minute! The slightest defect in the quality of the oil in such a case, by its becoming viscid, tells in the most serious way upon the quantity of fuel consumed in generating the power required to maintain at this high velocity such a multitude of moving parts. The slight increase of fluidity consequent on the rise of temperature, caused by the lighting of the gas in the rooms of a cotton-mill, makes a difference of several horses power in the duty of the engine of an extensive establishment.

The oil test we have now to describe, and which is an invention of Mr. Nasmyth's, consists of a plate of iron 4 inches wide by 6 feet long, on the upper surface of which six equal-sized grooves are planed. This plate is placed in an inclining position, say 1 inch in 6 feet. The mode of using it is as follows:—Suppose we have six varieties of oil to test, and we are desirous to know which of them will for the longest time retain its fluidity when in contact with iron and exposed to the action of the air; all we have to do is to pour out *simultaneously* at the upper end of each inclined groove an equal quantity of each of the oils under examination. This is very conveniently and correctly done by means of a row of small brass tubes. The six oils then make a fair start on their race down hill; some get a head the first day, and some keep a head the second and third day, but on the fourth or fifth day the truth begins to come out; the bad oils, whatever good process they may have made at the outset, come soon to a standstill by their gradual coagulation, while the good oil holds on its course, and at the end of eight or ten days there is no doubt left as to which is the best; it speaks for itself, having distanced its competitors by a long way. Linseed oil, which makes capital progress *the first day*, is set fast after having travelled 18 inches, while second-class sperm beats first-class sperm by 14 inches in nine days, having traversed in that time 5 feet 8 inches down the hill. The following Table will show the state of the oil race after a nine days' run:—

RESULTS OF OIL TEST.

Description of Oil.	First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh	Eighth.	Ninth.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Best sperm oil	2 8½	4 2	4 5¾	4 6	4 6	4 6	4 6⅛	Stat.	
Common sperm oil	1 7	3 9	4 6¾	4 11	5 1⅜	5 4	5 6¼	5 7⅜	5 8
Galipoli oil	0 10¼	1 2¼	1 6	1 6⅛	1 7⅝	1 8¾	1 9	1 9¼	1 9½
Lard oil	0 10¼	0 10⅛	0 10¾	0 10¾	0 11¼	Stat.			
Rape oil	1 2½	1 6¼	1 7	1 7⅛	1 7½	1 7½	1 7¼	1 7¾	Stat.
Linseed oil	1 5⅛	1 6	1 6¾	1 6¼	1 6¼	1 6¼	1 6¾	Stat.	

THE PROGRESS OF AN INVENTION.

Those only who have tried the experiment are at all able to understand the nature of the difficulties, and the number of discouragements which cross the path of a new invention. The less it resembles anything already known, the less likely is it to obtain favour. Once in a hundred times, probably, a novelty, at a single bound, leaps to the summit of popularity. This is an exceptive case. The other ninety-nine have to toil up the steep ascent, and they meet with many a slip, many a fall, many a failure. Why is this? Because it often happens that principles are right, whilst practice is

wrong. Because many who ask advice, never intend to follow it. Because there are so many who think if they do one thing better than their neighbours, they can do everything equally well. Inventors are, of all men, the most liable to mistake their vocations. Some use their hands instead of their heads. Others take the opposite course; trusting entirely to their heads, and doing nothing with their own hands, nor, what would be still better, directing the hands of others. This is not the worst that can be said. There are many who never know when to stop; spoiling many a good thought, and making a jumble of many an original idea, by efforts for its improvement. These are the mere schemers, who have no very exact conceptions of their own, and who, therefore, find great difficulty in imparting correct views to others.—*I. O. N. Rutter.*

THE DEODORIZING EFFECTS OF CARBON. BY PROFESSOR SCHONBEIN.

1. When ordinary charcoal powder is agitated, even but for a few minutes, with an aqueous solution of perfectly pure perchloride of iron, the latter, when filtered, strikes a deep blue colour with ferridcyanide of potassium, showing that under the above circumstances protochloride of iron is formed. When a definite quantity of the solution of the perchloride is treated long enough, and with a sufficient quantity of charcoal powder, the whole of the perchloride is converted to protochloride. This change is effected the more quickly the finer the charcoal is powdered, on which account calcined lamp-black is far more effective than ordinary charcoal powder. It deserves to be mentioned that even pulverised coke produces a similar effect upon the salt of iron.

2. The sulphate, nitrate, and acetate of peroxide of iron, dissolved in water, are completely converted into protosalts by agitation with charcoal powder; whence we are led to conclude that all persalts of iron dissolved in water, or in any other menstruum, may be converted by carbon, even without the assistance of heat, into protosalts.

With respect to the behaviour of carbon towards a solution of the pernitrate of iron, the following statements may be mentioned. If the solution is so dilute that it appears of a light yellowish-brown colour, and it is shaken for a few minutes with charcoal powder, the filtered liquid is of a much darker colour than the original solution. After further brief treatment with fresh charcoal, the colour of the solution becomes much darker; and after a third or fourth operation of the same kind, the liquid appears almost colourless; in which case it now contains no longer a trace of the persalt of iron, but only protosalt. This darkening of the colour arises from the charcoal removing not only oxygen from the solution of the persalt of iron, but some nitric acid at the same time; which gives rise to the formation of basic pernitrate of iron, the cause of the dark colour.

3. When the solution of the ferridcyanide of potassium is shaken only for a few minutes with ordinary charcoal powder, the filtered liquid strikes a pretty deep blue colour with perchloride of iron, or the solution of any other persalt free from protoxide. The same solution agitated for a sufficient time, and with a sufficient quantity of charcoal powder, is so changed, that it furnishes a copious dark blue precipitate with a solution of a persalt of iron, or leaves on evaporation a yellowish residue, which I have not yet been able to examine more closely, but which appears to consist for the greater part of ferrocyanide of potassium.

Regarding the dissolved ferridcyanide of potassium as a double salt, consisting of prussiate of potash and prussiate of the peroxide of iron, and the dissolved ferrocyanide of potassium as prussiate of protoxide of iron and potash, the above effect of the carbon might be explained from a conversion of the per into the protoxide of iron.

4. A solution of the perchloride of mercury, agitated sufficiently long with a suitable quantity of charcoal powder, is rendered tasteless and incapable of furnishing peroxide of mercury with solution of potash. The perchloride is converted under these circumstances into protochloride.

5. A dilute solution of pernitrate of mercury, perfectly free from protoxide, shaken but for a few minutes with charcoal powder, and then filtered, is rendered very turbid by muriatic acid or a solution of chloride of sodium arising from precipitated protochloride of mer-

cury, which proves that the charcoal converts a portion of the pernitrate of mercury immediately into protosalt, even in the cold. By shaking the same solution of pernitrate three or four times in quick succession, with fresh portions of charcoal powder, I succeeded in obtaining, in the course of a quarter of an hour, a protosalt perfectly free from peroxide. This property of carbon may be usefully employed in freeing soluble protosalts of mercury from any admixture of persalt.—*Poggendorff's Annalen*, lxxviii., p. 521.

A NEW LOCOMOTIVE.

A new engine, made from plans of Messrs. McConochie and Claude, of this town, at the establishment of Forrester and Co., was tried on Thursday last, on the Liverpool, Crosby, and Southport Railway. The principal improvements we understand to be the placing of inside cylinders behind the leading wheels, in connection with outside valve gearing and pumps, thus doing away entirely with the crowding together of this delicate and important part of the machinery underneath the boiler, as in the present engines, where it is all but inaccessible to the engineer and cleaner. The weight of the engine is about fifteen tons, of which nine tons are upon the driving and six tons on the leading wheels. On the trial trip she took a train of carriages from Waterloo to Southport with great velocity, and returned again in twenty minutes; being at the rate of 40½ miles an hour, including starting and stopping. At one part of the line, for five miles, the speed was about 60 miles an hour. The cost of the engine does not exceed 1,900*l.* Several scientific gentlemen and others connected with railways were present during the trial.—*Liverpool Mercury.*

[For a full description of Messrs. Mc Conochie and Claudes' plan, see *Mech. Mag.*, vol. xlix., p. 289.]

VELOCITY OF ELECTRICITY.

Messrs. Fizeau and Gounelle give the following as the results of certain experiments made by them with the wires of the Paris and Rome Telegraph :—

"1st. In an iron wire of 4 millimetres (0·16 in.) diameter electricity is propagated with a velocity of 101,710 kilimetres per second, say 100,000 kilometres (62,159 miles).

"2nd. In a copper wire of a diameter of 2·5 millimetres (0·1 in.) this velocity is 177,722 kilometres, say 180,000 kilometres (111,886 miles).

"3rd. The two electricities are propagated with the same velocity.

"4th. The number and nature of the elements of which the pile is formed, and consequently the tension of the electricity and the intensity of the current have no influence upon the velocity of propagation.

"5th. In conductors of different natures, the velocities are not proportional to the electric conducting powers.

"6th. When the discontinuous currents are propagated in a conductor, they experience a diffusion, in consequence of which they occupy a greater space at its point of arrival than at its point of departure.

"7th. The velocity of propagation appears not to vary with the section of the conductors; our experiments lead us to consider this principle as very probable.

"8th. If this principle is true, the velocity of propagation changes only with the nature of the conductor, and the numbers which we give represent the absolute velocities in iron and copper."—*Comptes Rendus de l'Acad. des Sciences de Paris.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING OCTOBER 16TH, 1850.

RICHARD PROSSER, of Birmingham, civil engineer. *For certain improvements in machinery or apparatus for manufacturing metal tubes, which improvements in machinery are in part applicable to other purposes where pressure is required; also for improvements in the mode of applying metal tubes in steam boilers, or other vessels requiring metal to be applied within them.* Patent dated April 11, 1850.

In consequence of the great length of this specification, we are able to give little more than a mere abstract of the claims, which are themselves unusually verbose and elaborate.

Claims.—1. Planing the edges of the skelps or pieces of metal before they are

bent or turned up into tubes. Two pieces of metal are held at a time in the moving table of a planing machine with their sides parallel to each other, and a series of compound cutting tools are used to remove the superfluous metal; such tools being placed at intervals along the edge, and consisting of two reversed cutters for planing in the backward as well as the forward stroke. The several parts of which these compound tools are formed are adjustable both laterally and longitudinally, and they are also capable of being removed for the purpose of grinding, in the event of breakage, and being replaced (when reduced by wear) in the position previously occupied by them respectively, relative to the position of the other cutters.

2. An improved mode of bending or turning up plates of metal for the formation of tubes, which consists in employing a long moveable bar for the purpose of holding the metal plate in a proper position over a mould by which it is first made to assume a gutter-like form, and then using two moveable side pieces to complete the bending process. The patentee claims also the arrangement of the several portions of apparatus one over another, in their relative positions, and the performance of all the stages by one motion of the pressing machine.

3. The application of steam power to the hydrostatic presses employed specially in the manufacture of metal tubes by the present improved process, which presses are also applicable to other purposes, such as stamping metal, forcing clay and other similar substances into moulds, and riveting for various purposes. The piston of a high-pressure cylinder is connected to a plunger in a water cylinder communicating freely with the water cylinder of a hydrostatic press. A stroke of the piston produces a corresponding one of the water-cylinder plunger, and injects water into the press with force sufficient to actuate its ram, which, on the water escaping by the backward stroke of the cylinder, falls down ready for a repetition of this action.

4. An improved method of fixing tubes in the interior of boilers and other vessels, the ends of such tubes being received in a belt of metal, slightly conical exteriorly, inserted in suitable holes in the side plates of the boiler, and fitting tightly between the exterior of the tubes and the interior of the holes in the side plates: this object being attained most effectually by forming the belts with a slit down one side, to allow of their tightly compressing the tube when forced in around it. By knocking out the belt any tube may be easily removed through the hole.

Robert Reid, of Glasgow, manufacturer. *For certain improvements in weaving.* Patent dated April 15, 1850.

Claims.—1. The production, by means of loom sewing, of figured fabrics having two, three, four, or more "covers" on each figure, or on any part thereof.

2. The production, by loom sewing, of all-over or continuous figures or patterns as closely contiguous to each other as may be desired, without the great waste of material consequent on the mode at present adopted of manufacturing figured fabrics.

3. Certain mechanism for regulating the position of the frame containing the shuttles, and also for throwing such shuttles across the warp.

John Turner, of Birmingham, engineer, and Joseph Hardwick, of the same place. *For a certain improvement or certain improvements in the construction and setting of steam boilers.* Patent dated April 15, 1850.

Claims.—1. The causing a current of heated air to pass across the anterior portion of a steam boiler through one or more flues; also the contraction of the fire-place immediately below the man-hole, so as to give greater room for the entrance of a man for the purpose of cleaning out the boiler.

2. A particular method of setting steam boilers, so as to have flues passing under and around the boiler, which flues are so arranged as to divide the current of flame and heated air, whereby a more equable distribution thereof over the surface exposed to heat is obtained.

Charles De Bergue, of Arthur-street, London, engineer. *For certain improvements in locomotive and other steam engines; also in buffers for railway purposes.* Patent dated April 15, 1850.

Claims.—1. The application of a small piston or pistons for communicating an expanding motion to the rings of metallic pistons, whereby a certain amount of pressure on the expanding ring may be ensured and regulated by the size of the small pistons.

2. An arrangement for relieving the cylinder from a portion of the weight of the piston, by cutting away a portion of the junk ring, and allowing the piston to rest principally on the metallic packing.

3. A peculiar arrangement and combination of the parts of buffers. This improvement refers mainly to an improvement on a station buffer formerly patented by Mr. De Bergue.

Cuthbert Dinsdale, of Newcastle-upon-Tyne, dentist. *For improvements in the manufacture of artificial palates and*

gums, and in the mode of setting or fixing natural and artificial teeth. Patent dated April 15, 1850.

Those parts of the invention which are new, and which Mr. Dinsdale claims, without, however, restricting himself to the "precise details" given, are—

1. An improved method of supplying the deficiency resulting from absorption of the alveolar process consequent on a total loss of teeth. For this purpose a wax cast of the upper and lower jaws is first taken, and a temporary plate formed of copper or other metal, with pins for retaining the teeth in position whilst a wax gum is moulded round them. In order to preserve the natural expression, this gum should, while in progress of formation, be occasionally fitted to the mouth. When the gum has been completed, and the teeth removed from their sockets, a plaster-of-Paris mould is taken in two parts for casting a zinc die; and by dipping this die in melted lead, a suitable counter die is obtained. A sheet of gold is then punched up to the required form, and soldered round the bottom to a lower plate. also of gold, whereby a hollow gum is formed, with sockets for receiving the teeth (by preference tubular mineral teeth.) The whole of the artificial gum is next enamelled, with the exception of the part which touches the mouth; and this enamel serves as a cement for the teeth, which are to have their ends closed with another enamel which serves to conceal the pins on which they are mounted. The spring carriage is of the ordinary description, but fitted so as to be removeable in case of need. When natural teeth are employed, the gum must be enamelled previous to their insertion, as the heat required for melting the enamel is greater than they will bear without injury, and instead of being fixed on pins, they must be cemented in.

2. The formation of artificial palates by a process similar to that above described—the distinctive feature in this, as in the former case, being that they are made hollow.

Edme Augustin Chameroy, of Paris. *For improvements in the manufacture of boilers, and of pipes of malleable substances as well as of elastic matter.* Patent datet April 15, 1850.

Mr. Chameroy claims:

1. A machine for rolling metal tubes, by which they may be formed of any bore and thinness of metal. This machine consists of two rollers, one of which has at each end a ruff or collar, and at the other a corresponding part cut away. A hollow cylinder of metal is introduced between these rollers, and after being sufficiently reduced by successive rollings, by which it acquires the form of a double plate connected at the edges, a tapering mandril is inserted between the surfaces, whereby the metal is opened out and forms a tube with a longitudinal rib on each side. In this state the tube can be applied to various useful purposes, such as supplying gas or water.

2. A machine for rolling tubes or other forms which is described to consist mainly of a series of conical rollers, having one part of their circumference with a cam surface arranged round a mandril, over which is placed the metal to be operated on. Rotary motion is communicated to these rollers, and the sliding frame supporting the mandril pushed forward till the metal assumes the required length and thickness. To remove the tube easily from the mandril, it is passed between concave rollers and thereby loosened.

3. The formation of tubes and other forms by rolling the material under operation between metal bars, which have a traversing motion to and fro imparted to them by suitable cranked gearing.

Floride Heindryckx, of Brussels, Belgium, engineer. *For improvements in propelling.* Patent dated April 15, 1850.

Claim.—The mounting of two or more *elastic* inclined vanes or wings (composed of steel, wrought iron, wood, or other material) on an arm or arms, fixed or attached transversely to the main or driving shaft, and causing these vanes or wings to rotate with the shaft, so that by acting on the water they may propel the vessel through the water.

This propeller is prepared to be placed at the vessel's stern, in the same manner as the screw; and if desired, two of them may be used, one on each side of the stern-post.

Amedge Francis Remond, of Birmingham. *For improvements in the manufacture of envelopes.* Patent dated April 15, 1850.

The improvements in the manufacture of envelopes, which are claimed under this specification, are—

1. The applying of cementing matter, in a dry and powdered state, to the flaps of envelopes previously moistened, and,

2. Removing the envelopes after the cementing matter has been deposited thereon, by means of atmospheric pressure.

Specification Due, but not Enrolled.

John Platt, of Oldham, Lancaster, engineer. *For certain improvements in machinery, or apparatus for spinning, doubling, and weaving, cotton, flax and other fibrous substances.* Patent dated April 11, 1850.

RECENT AMERICAN PATENTS.

(Selected and abridged from the *Franklin Journal.*)

Rocking Horses. *Eliphalet Scripture.*

"The nature of my invention," says the patentee, "consists in providing one or more mechanical horses upon a revolving platform, and in the centre erecting a series of cams around a centre post, and by hanging the horses at a point near the hip upon a centre, so as to admit of the head and forward part of the horse rising and falling—the before-named centre serving as a fulcrum. I then connect by levers the forward part of the horse, so that the levers will come in contact and be put in operation by a set or series of cams; each lever having a flexible connection to the horses, and one after the other in succession to be acted upon as the platform revolves, and thus, by the rising and falling of the forward part of the horse, produces an undulating motion very nearly resembling the natural motion of a horse when galloping."

Claim.—The combination and arrangement of the undulated cams with the levers, and these with the flexible connections to the front part of the horses, for the purpose of producing the rising and falling motion, which I term the galloping motion, as described.

Machine for Washing Crockery-ware. *Joel Houghton.*

"The nature of my invention," says the patentee, "consists in placing the crockery or other articles of table furniture in a machine fitted to receive them, and then to wash them by turning a shaft, with arms and buckets so arranged as to throw the water upon the crockery with force, and thus acting upon and cleaning each and every article."

Claim.—"What I claim as my invention, is the construction of a cylinder, with a cylindrical rack supported by an upright shaft resting upon, and being within and supported by the cylinder, the rack having within it a conical rack and hoop to receive and hold table furniture, in combination with a curb containing a horizontal wheel, with buckets to throw water upon the cylindrical rack—the whole supported by a frame; and by these mechanical means cleansing the surface of table furniture without the use of hands—the entire machine being arranged, combined, and operated substantially as is hereinbefore fully set forth."

Accelerating the Speed of Vessels. *Solomon Andrews.*

The object of this invention is stated to be, to obtain increased speed for boats, by an endeavour to overcome certain difficulties arising from the necessary displacement of the water to float them, and the increased resistance from friction and inertia of the water caused by increase of speed. This is obtained by giving to a boat such shape as will diminish its draught as the speed is accelerated; and as a consequence of this construction, is accomplished the injection of a small volume of air under the bottom, by the mere onward progression of the boat, and thereby still further reducing the friction of the water by diminishing the surface in actual contact.

Claim.—The forming a vessel with a scow-shaped bow, having on its sides two wide keels running the whole or a part of its entire length, and so constructed that a portion of the inclined surface of the bottom shall always be above the water at the bow, and this with or without the supplementary keels forming small channels, by which construction air enters at the bow in the manner set forth, and is retained under the bottom of the vessel for certain purposes described herein.

Improved Girder. *John Bevor.*

The first part of this invention consists in strengthening an arched girder or beam, and distributing the weight applied to or passing over it, by means of a metal strap, chain, or wire rope, which constitutes the cord, and which passes around the ends and over the entire length of the upper surface of the arch, whereby the arch is bound from end to end by the said metal strap, chain, or wire rope, to prevent it from spreading lengthwise—any tendency to elongate the cord having the effect to draw the said metal strap, chain, or wire rope down on to the upper surface of the arch, and thus to distribute any weight or pressure applied at any one point over the entire line of the arch.

The second part of this invention consists in providing the arched beam or girder with rollers at the ends, when this is combined with the metal strap, chain, or rope provided with a tightening screw or coupling for the purpose of regulating the length thereof, to adapt it to the changes of temperature, and to camber the beam or girder.

Claim.—The method, substantially as described, of strengthening arches by means of metal straps, chains, or ropes, which constitute the cords, and pass around the ends and over the arched surfaces thereof, without being attached thereto, in the manner and for the purpose specified.

And also providing the arch or beam with rollers at the ends, around which the strap, chain, or rope passes, substantially as described, when this is combined with a coupling or tightening screw for varying the

length of the said strap, chain, or rope, substantially in the manner and for the purpose specified.

MIRROR TRAP FOR RATS. *James Stevens.*

This trap is constructed in such a manner that the rat who looks at the bait shall see his own image reflected by a mirror in such a position as will lead him to believe that a second rat is endeavouring to get before him in seizing the bait; and when the first rat has been caught, his image will also be reflected by a mirror, so that the next rat who shall look at the bait shall see two rats apparently striving to seize it, thus decoying him upon the turning floor, which yields to his weight and precipitates him into the body of the trap.

Claim.—The arrangement of the mirrors, substantially in the manner, and for the purpose set forth.

WEEKLY LIST OF NEW ENGLISH PATENTS.

George Michiels, of London, gent., for improvements in treating and preparing potatoes for seed. (Being a communication.) October 17; six months.

John Fowler, jun., of Melksham, Wilts, engineer, for improvements in steam engines in raising and forcing fluids in irrigating and draining land, and in machinery for cutting wood for drain pipes and other uses. October 17; six months.

Daniel Trowers Shears, of Bankside, Surrey, copper merchant, for improvements in the manufacture and refining of sugar. (Being a communication.) October 17; six months.

John Robert Johnson, of Crawford-street, chemist, for improvements in fixing colours on fabrics made of cotton and other fibre. (Being a communication.) October 17; six months.

James Henry Baddeley, of Shelton, Stafford, engineer and designer, for improvements in the manufacture of ornamental articles of earthenware. October 17; six months.

Thomas Richards Harding, of Lille, France, manufacturer, for improvements in machinery for heckling and carding flax in machinery, for combing and drawing wool and other fibrous materials, and in machinery for making parts of such machines, and for a new arrangement of the steam engine for driving flax and woollen mills, which arrangement is also applicable to other purposes where motive power is required. October 17; six months.

Henry Bernoulli Barlow, of Manchester, consulting engineer, for improvements in spinning cotton and other fibrous materials. October 17; six months.

James Henry Williams, of Birmingham, manufacturer, for certain improvements in the manufacture of buttons. October 17; six months.

James Young, of Manchester, manufacturing chemist, for improvements in the treatment of certain bituminous mineral substances, and in obtaining products therefrom. October 17; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Oct. 10	2477	Louis Dutreilh	Wellington-street, Strand	Plantoform or instrument for measuring the feet of horses for facilitating shoeing.
,,	2478	Morris Gardiner	Ashill, near Watton	Lever spring-drop.
11	2479	John Gray and Robert Jon Keen	Liverpool	Anti-vibration elastic compass disc.
12	2480	John Smith	Uxbridge	Revolving sifter.
14	2481	Thomas Smith Freeman	Fenchurch-street	Safety pocket for waistcoats.
15	2482	Charles Beinhauer	Hamburg	Economical registered stove.

CONTENTS OF THIS NUMBER.

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BROOMAN'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF ZINC.

Fig. 1.

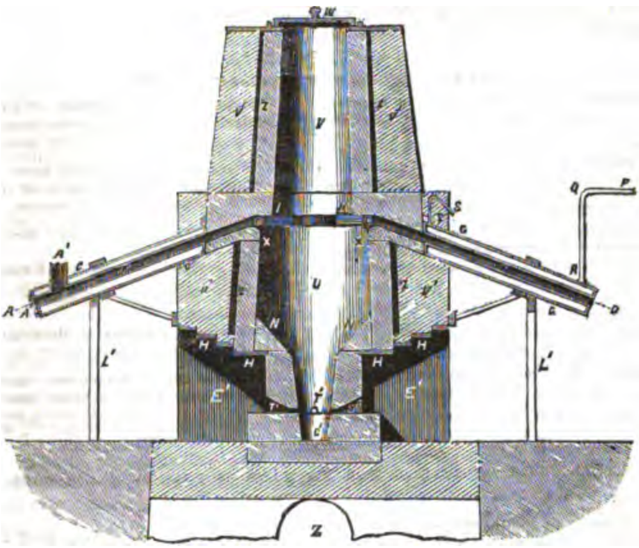
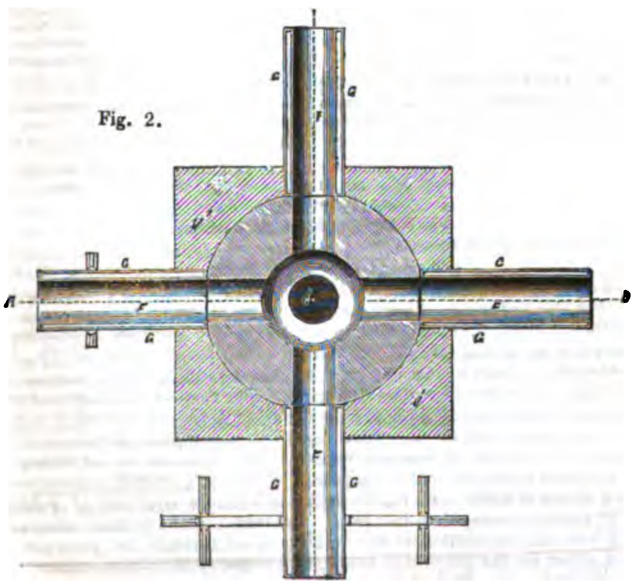


Fig. 2.



BROOMAN'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF ZINC.

(A Communication from Abroad.)

[Patent dated April 20, 1850. Specification enrolled October 20, 1850.]

The general object of this invention is to do away with the troublesome and expensive processes of assorting, pounding, and crushing, now ordinarily followed in order to the extraction of zinc from its ores; and this is effected by a method of direct reduction. We extract the following description of the apparatus employed, and of the peculiar processes followed in connection therewith, from the patentee's specification:—

Fig. 1 is a vertical section of the apparatus on the line AD of fig. 2. which is a horizontal section on the (dotted) line A, B, C, D of fig. 1. C is the hearth of the furnace; F, F, F are the tuyeres, which are three in number; N is the shoot; U the chamber of the furnace. So far the parts of the structure are very similar to those of a small blast furnace. At IK the upper part of the chamber U is suddenly contracted, so as to form a neck V, or narrow passage, between the upper and lower parts of the furnace. The charge, as it falls through this neck, leaves necessarily a vacant annular space at $x\,x$ between it and the sides of the furnace, where the volatilizable matters may collect. F F are four rectangular passages, formed of cast or sheet iron, which lead off at right angles, and in an inclined direction, from the annular space $x\,x$, and each passage is encased for a certain distance within a chamber G, through which cold water is kept continually circulating, flowing in from the tube P, Q, R, and escaping through the pipe S S. At the lower end of each of the rectangular passages there is a tubular passage A^1, by which the uncondensed gases of the furnace are carried off to different points, to be employed for heating purposes, as hereafter explained; and each passage is provided at its lower end with a sliding door A^2, which may be closed or opened as required. W is a lid or cover by which the furnace is closed at top, and which fits into a groove made for it, so that there may be no escape of the gases at that part. All the interior parts of the furnace are formed of fire brick, with an outer wall or casing V^1, which may be made of ordinary brick; and between the outer and inner walls there is left a space Z Z, which is filled with some substance which is a bad conductor of heat. H H are strengthening plates of cast iron, which are inserted into the lower brickwork V^1, immediately over the tuyere openings E^1 E^1. L^1 are cast iron frames, which carry the passages F F and cold-water chamber G.

The mode of operating with the apparatus is as follows:—After the furnace has been built, it is left to dry; then a fire is kindled on the hearth, and kept up for about three weeks by supplies of fuel (by preference coke), introduced through the throat. The furnace being in this manner filled with incandescent fuel, a small charge of quick lime is thrown in. As soon as this charge has descended as far down as the tuyeres, a mixture of ore, flux, and fuel is fed into the furnace, the top of the furnace closed, and a moderate blast of atmospheric air applied by means of a blowing machine.

The fuel, the flux, and the ore are in such proportions to one another that the whole of the zinc contained in the ore shall be reduced, and then volatilized, while all the foreign matters shall form with the flux a residual slag of more or less fluidity when in the heated state. The fuel employed may be either charcoal, or coke, or common coal, or anthracite, or turf, taking care always that it is of a sufficiently hard nature to resist the incumbent pressure of the charge in the furnace.

The quantity of fuel employed should be greater at the commencement than during the subsequent stages, and should in all cases be sufficient not only for the complete reduction of the zinc, but also to leave so considerable an excess that when it arrives directly before the tuyeres, the combustion of the fuel shall not give rise to any gaseous oxidating product; such, for example, as carbonic acid. The flux (the selection of which, as well as that of the fuel, depends on the quality of the ore) must be used in such a state as not to produce any oxydating matter during the formation of the slag. For this reason, when the nature of the ore requires the employment of lime as a flux, the lime should be used in a caustic state, and not as a carbonate; and for the same reason it is advisable to use a blast of dry air, that is to say, air deprived of aqueous vapour. The products of the furnace are, in the first place, the gases arising from the combustion of the fuel; secondly, the vapours of zinc; thirdly, the non-volatilizable matters, consisting of scoræ or slag and of reduced metallic substances of greater density than the zinc. The throat of the furnace being closed, "the gases arising from the combustion of the fuel" pass off through the passages A^1, and are made use of either for the purpose of heating the boiler of the steam engine which drives the blowing machine, or to burn lime when used for a flux, or to melt the zinc which is

carried over in a state of vapour, or to dry and roast the ores. The "vapours of zinc" are condensed in the passages F F, and may be easily withdrawn therefrom by means of a rake (the rectangular form of the passages F F affording great facilities for this purpose), after which they are reduced and formed into ingots or bars. The "non-volatilized" or residual matters, which collect on the sole or hearth of the furnace, are run off from time to time according as they accumulate.

The ores containing zinc may be divided into two classes; firstly, those in a state of oxide, either free or combined with carbonic or silicic acid; secondly, those containing sulphuret of zinc (blende.) When the ores are of the first class (oxides), they are first dried, and if they contain a carbonate, they are subjected to a roasting process. The flux employed for the treatment of ores of this class is quick lime, the quantity of which varies according to the quantity of earthy matters contained in the ore, but should be sufficient for the formation of a bisilicate, or, as it is commonly called, a good slag. When the ores contain any other metals, such as iron or lead, these metals are reduced to the metallic state, when they collect on the sole of the furnace, where they arrange themselves in different strata according to their respective densities, and may be drawn off separately. When the ores are of the second class (blende), they are treated in one of two ways; either by roasting, which brings them into the state of oxide, which oxide is then mixed with a little damp clay and formed into blocks, which, after being dried, are treated in the manner before described; or (which is considered the preferable way), these sulphurous ores are mixed with a quantity of iron ore, so that when the metals are fused the iron shall combine with the sulphur, and set the zinc at liberty.

The flux employed in this case is quick lime, and if the ore contain a portion of baryta or gypsum, then fluorine is added. The quantity of quick lime employed depends on the quantity of earthy matters contained both in the zinc and iron ores. The iron ore best suited for this purpose is that containing zinc, but in too small a quantity to be treated separately as a zinc ore. When, however, the iron ore contains water or carbonic acid, it is necessary that these should be expelled by roasting, in order that no substance susceptible of oxydizing the zinc may be introduced into the furnace. If the iron ore contain too great a quantity of oxydating matter, then it is preferable to expel the sulphur from the zinc ore by means of cast iron or malleable iron. This plan presents the advantage of driving off the whole of the substances capable of reoxidizing the zinc which has been reduced. When a sulphuret of zinc in which there are several other metals, such as iron, copper, lead, silver, &c., is treated in the furnace, there collects on the sole, besides the slag a stratum of argentiferous lead, on which is superimposed a stratum of cast iron arising from the excess of iron ore used in the process. Again; above the stratum of iron there collects a mass composed principally of sulphuret of iron, sulphuret of copper, and portions of the sulphurets of other metals.

If white, gray, or yellowish oxide of zinc should be formed accidentally in the passages FF, it can be made use of directly as a colouring matter, and sold as such; or else it can be mixed with damp clay, made up into blocks, dried, and again passed through the furnace; in which case a sufficient quantity of quick lime should be added, to convert all the clay into a fusible slag.

When ores containing zinc in a state of oxide have to be treated, they should be previously assayed, in order to effect an analysis, and to ascertain the quantity of earthy matters contained therein capable of being converted into scoria, and which will determine the proper proportion of quick lime to be added. The lime and magnesia contained in the ore are also to be taken into account.

When ores containing zinc in the state of sulphurets have to be treated, the quantities of sulphur, earthy matters, and metallic substances contained therein should also be ascertained by preliminary assay, so that the quantity of iron ore used in the charge shall be sufficient to produce the cast iron requisite for combining with all the sulphur that may be in the zinc. In order that the combination of the sulphur and iron may be the more completely effected it is advisable to employ a slight excess of iron ore. But if there should be reason to apprehend that the iron ores might produce too great a quantity of oxidating matter, and thereby create too great a quantity of oxide of zinc; then cast or malleable iron may be directly used for the purpose of combining with the sulphur, in which case the proportion of cast or malleable iron is to be determined by the quantity of sulphur contained in the ore, always employing a slight excess of the iron. The proportion of quick lime or of fluorine used for making a fusible slag will depend on the quantity of earthy matters contained in the ore to be treated, as well as in the iron ore when used for combining with the sulphur. The quantity of fuel employed in this case will depend not only on what has been already stated, but also on the richness and fusibility of the iron ores, and in all cases

should be so regulated that the working of the furnace shall in all respects resemble that of a blast furnace for casting purposes.

As sulphuretted ores contain generally other metallic substances besides zinc, a great quantity of reduced metals, and of crude metals, composed principally of sulphuret of iron, will collect on the hearth of the furnace, and combine with the sulphuret of copper and a portion of the sulphurets of the other metals. In this case, therefore, it is better to run off the metal more frequently than in the preceding cases. The lead thereby obtained can be recast into pigs ready for sale, or submitted to the process of cupellation, if it should contain silver; and any other masses of crude metal, may be treated by any of the well-known processes in order to extract the copper therefrom. As in the preceding cases, the whole of the zinc will be volatilized, and collected condensed in the passages FF, and chamber G.

From the preceding description, it will be seen that the distinguishing features of the improved apparatus and processes, which form the subject of this invention, are these:

Firstly. The direct reduction of the ores of zinc by means of a smelting furnace and blowing apparatus, without any previous assorting, pounding, or crushing.

Secondly. The employment of a smelting furnace for this purpose of the peculiar description represented in the engravings, and before described; that is to say, of a furnace having a narrow neck or passage, by the descent through which of the charge an annular space is formed around it in the top or crown of the furnace, where the vapour of zinc collects, but are prevented by the heat from condensing; having also passages of a rectilineal form through which the vapours of zinc pass off to be condensed (a form which allows of the rake traversing and completely clearing the passages from end to end); and farther condensing chambers, through which a current of cold water is kept continually flowing in order to aid the process of condensation.

Thirdly. The avoidance of introducing into the furnace any substance capable of reoxidizing the zinc produced, which is effected by the selection of quick lime as a flux, by the drying and roasting of the hydrated and carbonated ores of zinc and iron, by the drying (in certain cases) by means of hot blast, and by the employment of cast or malleable iron, for the purpose of combining with and extracting the sulphur contained in sulphurated zinc ores.

Fourthly. The direct treatment of blende which has not been roasted, and the reduction thereof by means of the iron employed, that is either the cast or malleable iron, or the iron produced by the ore, which becomes converted into cast iron, or sulphuret of iron, in the furnace itself.

Fifthly. The peculiar method of treating sulphuretted, or arseinuretted ores of lead and copper, containing zinc, whereby the zinc is separated from these other metals, and obtained in a metallic state. And,

Sixthly. The method of turning the zinc contained in ores of iron to good account without injuring the latter metal.

THE HOLYHEAD STEAM SHIPS.

Sir,—The perusal of the evidence of the Committee of the House of Commons during the last session, on the Holyhead steam ships, whilst it has induced me to change some of my views, and obliges me to correct one or two statements made on the published authority of those who should have been in possession of accurate information, has in no way altered my opinion respecting the illiberal and impolitic conduct of the Government in their negotiations with the Chester and Holyhead Railway Company, and confirms me in the opinion I previously expressed as to the City of Dublin Company being at present unable to efficiently perform the mail service. (See *ante* p. 350, 365). At the time this Company contracted for the service they had actually no vessel of their own which could comply with the Admiralty conditions as respects speed—the *Eblana*, the newest and fastest, being unable to perform the passage at the stipulated average rate of 15 knots an hour. The *Iron Duke* was found quite unequal to the service and was speedily withdrawn, and the Company were compelled to fall back upon the *St. Columba* (which they agreed to purchase from the Admiralty), and the *Banshee* and *Caradoc*,—borrowed vessels; the *Llewellyn*, as I before mentioned, was also purchased from the Admiralty, but at the time of agreement was totally unserviceable. The *Eblana* was therefore retained.

As might be expected, the service has not been so efficiently performed as when

in the hands of the Admiralty; and one of the witnesses, Mr. Burrowes of the Dublin Post-office, stated that the arrivals of the mail, since the City of Dublin Company entered on the contract have been more irregular. Captain Moorsom, R.N., the Managing Director of the Railway Company's boats, gives in his evidence some very interesting information respecting their working. He states, that from the commencement of their running (August 1, up to the 31st of December, 1848,) no restriction beyond the avoidance of actual danger was put upon their speed; and he adds, "Having given those directions with those cautions to the officers, I was as much on board myself as I could be from my other pursuits, and I was in constant communication with the engineers upon the pressure they were to use, and so on; this period I have marked by the time being a minimum—they were to go as fast as they could in the least time. I have marked it at pressure at the maximum; they might go up to as many pounds pressure as the boilers were calculated to bear, and the maker considered to be safe, which was from 19 to 31 lbs. in two boats (*Anglia* and *Scotia*), but not so high in the other two (*Cambria* and *Hibernia*). The expansion, that is to say the quantity of steam put into the cylinder, was also to be minimum."

This mode of working, however, was found to be too expensive, and a more moderate and cautious one needful; consequently he directed that in future "on no occasion were the boats to make the passage in less than four hours and a quarter: but to aim at making it in four hours and a half, that the time should be constant, and that the pressure and expansion should be varied according to the circumstances under which they found themselves placed: for example,—In starting from Kingstoun if they had an ebb tide drawing out of the bay, and a perfect calm, they would have every thing to assist them, and therefore the pressure was to be reduced to the minimum, and the expansion put to the greatest amount and the least quantity of steam put into the cylinder. If, on the contrary, they were starting with the tide coming in an opposite direction, and with an easterly wind against them, they were to put the pressure to the maximum and fill the cylinder; and under those relative conditions they would make the passage pretty nearly in the average time. The results in the saving of fuel are as stated (see accompanying Table), and are very remarkable; they show how thoroughly the speed of the steam-boat governs the consumption of fuel, and that what theory would indicate is carried out in practice; that as you increase the speed you increase the consumption of all kinds pretty much as the square. The boats are going nearly twice as fast as any ordinary steam-boats, and they consume between three and four times the amount of fuel—and that is the key to the expense." The Table alluded to, No. 1, by Captain Moorsom, though not so arranged in the Parliamentary Report, embraces four periods; viz., August 1, to December 31, 1848 (the period of extreme speed and pressure), and three others, January 1, to June 30, and July 1, to December 31, 1849, and Jan. 1 to March 31, 1850, being those of reduced speed and pressure. For these three last periods it is difficult to fix the pressure; but possibly the general average may be given at 14 to 15 lbs. When the race between the *Scotia* and *Banshee* took place in 1849, the pressure of the *Scotia* was 15 lbs., that of the *Banshee* 14 lbs. I stated, in a former paper, 10 as the *Scotia's* pressure, and I did so on the authority of a letter in the *Dublin Freeman's Journal*, written by one of the Company's officials. Captain Moorsom was particularly questioned relative to the pressure used on the railway steamers on that occasion, as to whether it was not increased to more than 15 lbs. during the passage; nothing however appears, but that the extracts he produced from the journal of the engineer and log of the commander are perfectly correct. Captain M. is however very candid, admitting that the *Scotia ought to be* the fastest vessel, "because she has more power in proportion to her displacement; her power in proportion to her displacement is as nearly as possible three-fifths:" he states also, "that he knows no vessel where the proportion is so large."

In my first papers, which appeared in the Numbers of your Magazine for May 4th and 11th, I was unable, as I stated, to supply several particulars relative to

TABLE, No. 1.

Name.	Displacement in Tons.	H. P.	PERIODS. No. 1, Aug. 1 to Dec. 31, 1848. 2, Jan. 1 to June 30, 1849. 3, July 1 to Dec. 31, 1849. 4, Jan. 1 to Mar. 31, 1850.	Shortest Passage.	Average speed per hour in statute miles.	Average mean Passage.	Pressure.	Coals consumed each Passage.	General average Time of Passage.	General average Speed per hour in Stat. Miles.	Observations.
				h. m.		h. m.		tons. cwt.	h. m.		
Anglia ..	650	350	Period No. 1	3·25	$15\frac{8}{10}$	3·59	19—21	15 5	4 10	$15\frac{14}{100}$	
			— — 2	3·33	$14\frac{8}{10}$	4·14	Conditnl.	14 3	....	....	
			— — 3	....	....	....	Do.	....	....	....	Anglia laid up during Period.
			— — 4	4·6	$13\frac{9}{10}$	4·31	Do.	10 10	....	....	
Cambria..	750	370	— — 1	4·5	$14\frac{1}{10}$	4·28	14	15 3	4 29	$14\frac{68}{100}$	
			— — 2	4·5	14	4·30	Conditnl.	14 16	....	....	The average Mean Time of all the Boats 4h. 30m.; ditto speed 14m.
			— — 3	3·57	$14\frac{3}{10}$	4·25	Do.	13 1	....	....	
			— — 4	4·0	$13\frac{5}{10}$	4·34	Do.	12 6	....	....	
Hibernia.	660	370	— — 1	4·18	$11\frac{1}{2}$	5·16	15	23 2	5 0	$12\frac{6}{10}$	
			— — 2	4·13	$12\frac{8}{10}$	5·0	Conditnl.	16 16	....	....	
			— — 3	4·13	$12\frac{1}{14}$	4·55	Do.	15 5	....	....	
			— — 4	4·30	$12\frac{1}{10}$	5·10	Do.	18 5	....	....	
Scotia ..	680	400	— — 1	3·28	$15\frac{8}{10}$	3·59	19—21	17 8	4 21	$14\frac{48}{100}$	
			— — 2	3·24	$15\frac{1}{10}$	4·9	Conditnl.	15 15	....	....	
			— — 3	3·56	$13\frac{4}{10}$	4·38	Do.	13 4	....	....	
			— — 4	4·0	14	4·29	Do.	13 9	....	....	

Table, No. 11.

Extracts from Return of Engineer and Report of Commander of "Scotia" Steam Ship, May 24th, 1849.

Departure Holyhead.	Arrival Kingstoun.	Sail Set.	No. of Revolutions per minute.	Barometer. Highest.	Barometer. Lowest.	Hydrometer. Highest.	Hydrometer. Lowest.	Safety valves, actual pressure at which they are worked.	Expansion in proportion of cylinder.	Steam gauge or indicator. Highest.	Steam gauge or indicator. Lowest.	Wind.	Length of Voyage.	Observations.
h. m. 6 0 P.M.	h. m. 9·56 P.M.	Fore Sail.	26 to 28	27·5	27	1·9	1·4	15 lbs.	$\frac{11}{18}$	15	15	S. S. W.	h. m. 3·56	First part, fresh breeze and hazy. 5·58 backed out of the pier and canted the ship; 6·, set on full speed; the "Banshee," with the Lord Lieutenant on board, in company. Our steam became low at starting; the steam of "Banshee" blowing off, she gained on us slightly for a short time. 6·15 got steam up to limited pressure, 15 lbs.; found we gained fast on "Banshee," and continued to do so the whole of the trip, and arrived at the Quay of Kingstoun 16 minutes before her. Middle and latter part of the passage, strong winds and heavy short sea at intervals; steam regular at 15 lbs. the chief part of the passage.

Return of the Draught, Horses Power, Number of Trips run, the Longest, Shortest, and Average Length of Passages, and Average Rate of Speed from the 3rd of May to 26th of May of the Contract Holyhead Mail Steam Ships "Eblana," "Iron Duke," "Banshee," "Caradoc," and "St. Columba," and Chester and Holyhead Railway Company's Steam Ships "Anglia" and "Cambria." Also of the Consumption per Hour and per 100 Miles, Total Number of Nautical Miles run to April 30, 1850, Total Cost and Date of Commission of the "Banshee," "Caradoc," "Llewellyn," and "St. Columba" Steam Ships.

Name of Steam Ship.	Draught. fore.	Draught. a ft.	H. Power.	No of trips of 54·6 nautical ms. or 63 stat. ms.	Holyhead to Kingstoun. Longest	Holyhead to Kingstoun. Shortest	Holyhead to Kingstoun. Average	Kingstoun to Holyhead. Longest	Kingstoun to Holyhead. Shortest	Kingstoun to Holyhead. Average	Average of the Double Trip.	Ave. rate of Speed Miles. Nautical	Ave. rate of Speed Miles. Statute	Date of commis. of Admiralty stm. ships.	Dist. run in nautical miles to Ap. 30, 1850	Total Cost.	Consump. of coals per hour.	Consump. of coals per 100 miles.	Observation.
	ft. in.	ft. in.												1846.		£.	cwt.	cwt.	
Eblana.....	9 0	9 6	375	2 & 2	4·54	4·31	4·42	5·1	4·30	4·45	4·43	11·5	13·3						It will be remarked that the number of miles run by the Banshee and St. Columba greatly exceed those of the Caradoc and Llewellyn, and that the last vessel has cost more than any of the others, without taking into account repairs, which have been more expensive than any of the rest.
Iron Duke	10 7	10 11	320	14 & 15	6·2	4·45	5·18	5·38	4·50	5·13	5·15	10·4	12·1						
Banshee ...	8 6	8 8	350	12 & 12	4·35	4·1	4·11	4·28	3·55	4·9	4·10	13·1	15·1	Jan. 5.	41161	37640	64½	516	
Llewellyn.	8 7	9 0	350	—	—	—	—	—	—	—	—	—	—	May 3.	27836	40887	58½	468	
Caradoc ...	8 0	8 10	350	4 & 3	6·40	4·48	5·25	5·25	4·30	4·52	5·10	10·5	12·2	Apr. 4.	27160	36848	56½	452	
St. Columb	8 10	8 10	350	16 & 16	5·6	4·22	4·44	5·25	4·19	4·34	4·39	12·09	13·9	Mar. 1.	38357	36930	41½	332	
Anglia ...	8 6	8 7	350	11 & 10	4·54	3·54	4·22	4·54	4·15	4·25	4·23	12·4	14·3						
Cambria...	9 4	9 8	370	9 & 10	4·33	4·17	4·23	4·33	4·10	4·23	4·23	12·4	14·3						

the Admiralty boats which I had given of the Railway Company's. Some of these,—the consumption and cost for instance,—have been obligingly communicated by a gentleman connected with the former; and they are, with a few other details collected from the evidence before the Common's Committee, now published. I think an impartial examination of these, together with an attentive observation of the working of the whole four of these Admiralty vessels, must afford convincing evidence that in actual service the *Banshee* and *St. Columba* have done the most, and that the speed of the former has no equal amongst the Government vessels;—though both the *Anglia* and *Scotia*, but especially the former, now are decidedly her superiors. During last month the railway boats, on more than one occasion had, on special engagements, to leave at the same time as the mails; on one of these the *Anglia* and *Banshee* left Kingstoun together at 1 P.M.,—the former beating the latter in the run to Holyhead by 19 minutes.

I am, respectfully,

SAMUEL DARTON.

Dublin, 17th of 10th month, 1850.

ELECTRIC TELEGRAPH BETWEEN ENGLAND AND IRELAND.

Sir,—The importance of a communication by Telegraph between England and Ireland has been acknowledged by all parties: and the partial success of electricity, between Dover and Calais, by a submarine wire, gives a good assurance that the efforts of Messrs. Brett, Woollaston and Co., will be ultimately successful; and therefore, that the question of an electric telegraph between London and Dublin is one merely of time. To effect this, offers have been made by certain parties to the Lords of the Admiralty and Government authorities; and two points are stated to have been selected by them, to lay the missive wires across the Channel; viz., at St. David's Head, and Holyhead—each of which is distant about sixty-four miles from the coast of Ireland. Without questioning the probability of such a scheme, there are however in my humble opinion two other places, which present more eligible positions than those; viz., Portpatrick in Wigtonshire, and the Mull of Cantyre, in Argylshire; the former place being twenty-one miles from Donaghadee in Downshire, and the latter but fourteen miles distant from Forhead in Antrim. It is granted, that the shortest way for passengers and traffic from London to Dublin, by railway and steam boat, is through Holyhead; but it does not follow, in communicating with places by electric telegraphs, that the shortest length of wire is necessary, and ought to be adopted in preference to any other; except it were proved to be the best. It fortunately happens, that when use is made of that extraordinary agent for this purpose, that distance in any appreciable time from the great velocity of the electric fluid is of no moment—one mile is as a thousand. Therefore, for all practical purposes, it is perfectly immaterial, whether the communication from London to Dublin be by St. David's Head or Holyhead, or Portpatrick, or the Mull of Cantyre, or between Dublin and Holyhead, through Ireland, Scotland, England and Wales, or between the proposed Atlantic Station in Galway and London; the time in the transmission of any intelligence would in all the cases be sensibly alike. The chief difficulties which present themselves, are the construction of the sub-marine wires, and fixing them securely in the Channel; and, if the disadvantages of them are in proportion to their length, there would be, supposing the connection with Ireland were made from Portpatrick, one-third less length of wire, one-third less chance of breakage, one-third less trouble in finding and repairing the broken parts, and if made from the Mull of Cantyre, these drawbacks would be reduced to nearly one-fifth. The experience of Messrs. Brett and Co. in laying the wire between Dover and Calais, shows that stronger and different tackle than were first used are necessary for the success of the undertaking; and, we are told, that the cost of two wires constructed on the plan now proposed, and placed three miles apart, will be 40,000*l.*; which sum, if similar wires were carried from Portpatrick, would likewise be required: but if carried from the Mull of Cantyre, would be reduced to about 27,000*l.*; whilst if made from St. David's Head, or Holyhead, would not be less than 120,000*l.* It is therefore for the promoters of the scheme, and others interested in it, to

consider whether it would be better to have a shorter length of line, with a greater length of submarine wire forming part of it, or a greater length of line with a less length of submarine wire forming part of it. Of the two points in Scotland, from which it is proposed to lay the wires, I believe that by Portpatrick would be found the most advantageous, if there be no serious impediments in the Straits, which soundings made by competent parties would soon prove; because it is a packet station, the nearest to Ireland, and connects Great Britain with the most important part of it commercially considered,—if not now done, the great and increasing trade and political importance of the North will shortly require it; moreover, it is most favourably situate for the wires branching right and left to England and Scotland, and has the further advantage over Holyhead or St. David's Head of giving two distinct lines of telegraphs to London,—one by the London and North Western through Carlisle, and the other by the direct Northern and other lines through Edinburgh, &c. Such a double line of communication might be found of the greatest service if important intelligence had to be transmitted, and the wires of one line were from any cause broken. It is therefore suggested, that Portpatrick and the Mull of Cantyre shall receive the consideration, which, I think they deserve, in selecting a place to connect Ireland with Great Britain by electric telegraph, in order that the choice when made may offer the best guarantee of combining durability with economy.

M. D.

Manchester, Oct. 19, 1850.

NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Continued from p. 125.)

Third and Concluding Series.

V. CUBIC EQUATIONS.*

From the equation (2) [*supra*, p. 124,] we obtain, in the same manner as at p. 249, of vol. ii., of the *Cambridge Mathematical Journal*,

$$y=\frac{B}{\sqrt[3]{A^3-3AB}-A}=\frac{(3z+a)z+az+b}{\sqrt[3]{(a^2-3b)(3z+a)}-(3z+a)}\dots\dots\dots\dots(3.)$$

Let the symbol α include *all* the cube roots of unity; also let $a^2-3b=n$, and $3z+a=\rho$; then the equations

$$x=y+z=\frac{(\alpha^3\sqrt{n\rho}+a)z+b}{\alpha^3\sqrt{n\rho}-\rho}=-\frac{1}{3}\left\{\alpha^3\sqrt{n\rho}+a+\alpha^2\sqrt[3]{\frac{n^2}{\rho}}\right\}\dots\ .)$$

will be strictly true. I may observe that in the *first* step of the division by which the final expression for x is obtained the divisor is written $-3x+\sqrt[3]{n\rho}-a$.

If in the expression for ρ we substitute for z its value, given by (3) [*supra*, p. 124,], we find

$$\frac{n\rho}{27}=\left(\frac{a}{3}\right)^3-\frac{ab}{3\cdot 2}+\frac{c}{2}+\left\{\left(\frac{c}{2}\right)^2+\left(\frac{b}{3}\right)\quad+c\left(\frac{a}{3}\right)^3-\frac{ab}{4\times 27}(ab+18c)\right\}^{\frac{1}{2}};$$

and this last expression we may suppose to be represented by $p+\sqrt{R}$. We shall then have

$$\frac{n^2}{27\rho}=\frac{n^2}{27}\times\frac{n}{27(p+\sqrt{R})}=\frac{n^3}{27^2(p+\sqrt{R})}$$

$$=\frac{n^3(p-\sqrt{R})}{27^2(p^2-R)}=p-\sqrt{R},$$

$$\text{for, } p^2-R=\left(\frac{a^2}{9}-\frac{b}{3}\right)^3=\left(\frac{n}{9}\right)^3=\frac{n^3}{27^2},$$

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* A paper of the same general character as the present was, some weeks previous to the date of this "Note," forwarded to the *Mechanics' Magazine*, but, it having been accidentally lost, and no copy kept, Mr. Cockle has re-written it.

as we see by actual substitution for p and R. Hence, from (4) we obtain,

$$x=-\frac{1}{3}(a+\alpha\,{}^{3}\sqrt{p+\sqrt{R}}+\alpha^{2}\,{}^{3}\sqrt{p-\sqrt{R}})=-\frac{1}{3}\Big\{a+$$

$$\alpha\,{}^{3}\sqrt{\Big[\Big(\frac{a}{3}\Big)^{3}-\frac{ab}{3\cdot 2}+\frac{c}{2}+\sqrt{\Big\{\Big(\frac{c}{2}\Big)^{2}+\Big(\frac{b}{3}\Big)^{3}+c\Big(\frac{a}{3}\Big)^{3}-\frac{ab}{4\times 27}(ab+18c)\Big\}}\Big]}$$

$$+\alpha^{2}\,{}^{3}\sqrt{\Big[\Big(\frac{a}{3}\Big)^{3}-\frac{ab}{3\cdot 2}+\frac{c}{2}-\sqrt{\Big\{\Big(\frac{c}{2}\Big)^{2}+\Big(\frac{b}{3}\Big)^{3}+c\Big(\frac{a}{3}\Big)^{3}-\frac{ab}{4\times 27}(ab+18c)\Big\}}\Big]}\Big\}$$

which expression may be compared with that given at p. 51 of MURPHY's *Theory of Equations.*

On inspecting the above expression for x, it is not difficult to perceive that, if z_1 and z_2 be the values of z,

$$x=-\frac{1}{3}\{a+\alpha\,{}^{3}\sqrt{(a^{2}-3b)(a+3z_{1})}+\alpha^{2}\,{}^{3}\sqrt{(a^{2}-3b)(a+3z_{2})}\}\ldots\ldots(5.)$$

The above reductions may be somewhat differently performed, by a process which I gave in a Mathematical Note, at pp. 285-6 of vol. i. of the *Cambridge and Dublin Mathematical Journal.* It is as follows: let

$$A^{3}-3AB=D^{3},\text{ and, consequently, }B=-\frac{1}{3A}(D^{3}-A^{3});$$

then, the general expression for y is

$$y=\frac{B}{\alpha\,{}^{3}\sqrt{A^{3}-3AB}-A}=-\frac{1}{3A}\cdot\frac{D^{3}-A^{3}}{\alpha D-A}=-\frac{1}{3A}(\alpha^{2}D^{2}+\alpha AD+A^{2})$$

$$=(\text{on reduction,})-\frac{1}{3}\Big(A+\alpha D+\frac{\alpha^{2}D^{2}}{A}\Big);$$

$$\text{and, }x=y+z=-\frac{1}{3}\Big(a+\alpha D+\frac{\alpha^{2}D^{2}}{A}\Big).$$

$$\text{Now, }D={}^{3}\sqrt{(A^{2}-3B)A}={}^{3}\sqrt{(a^{2}-3b)A}={}^{3}\sqrt{(a^{2}-3b)(a+3z_{1})},$$

z_1 being either value of z. Let $a+3z_1=\rho_1$, and $a+3z_2=\rho_2$, then I have shown, at p. 195 of vol. i. of the *Mathematician*, that $\rho_1\rho_2=n$. Hence, since $A=\rho_1$, we have

$$\frac{D^{2}}{A}={}^{3}\sqrt{\frac{n^{2}\rho_1^{2}}{\rho_1^{3}}}={}^{3}\sqrt{\frac{n^{2}}{\rho_1}},$$

and we obtain an expression for x which coincides with that already arrived at. It will be observed that, since $n^{2}=n\,\rho_1\,\rho_2$, we may put the expression for x under the form

$$x=-\frac{1}{3}(a+\alpha\,{}^{3}\sqrt{n\,\rho_1}+\alpha^{2}\,{}^{3}\sqrt{n\,\rho_2}),$$

which is identical with (5).

I shall now proceed to apply to Mr. LOCKHART's equation (*vide supra*, p. 124) the Rule which I gave at pp. 489—490 of the last (52nd) volume of the *Mechanics' Magazine.* My process will be as follows:—

−10	+10	.	−7.92489303
−10	−10	.	—10.
100	−100.	.	79.2489303
30	− 23.77467909	.	100
70	2) − 76.22532091	.	−20.7510697
		.	70.
	− 38·112660455	.	
		.	1452. 574879
$(38.112660455)^2=$		.	1452. 574886958120807025.

Hence, the final result being negative, I infer that the cubic in question has *all* its roots real—a conclusion different to the one arrived at by the distinguished framer of this curious and valuable example (*vide supra*, p. 124).

My rule rests for its demonstration upon the dependence which exists between the nature of the roots of the given cubic and those of the equation in z. Now the values of z are real and unequal, equal, or unreal, according as the expression

$$(ab-9c)^2-4\,(a^2-3b)\,(b^2-3ac)$$

is real, zero, or negative respectively. This expression, when developed, reduced, and multiplied by 3, is, in fact, the same as that under the radical sign in (3), *supra*, p. 124. The Rule in question is a practical process for ascertaining the sign of the expression just given.

JAMES COCKLE.

2, Pump-court, Temple, Sept. 24, 1850.

PHILLIPS' FIRE ANNIHILATOR—WATER TRIUMPHANT.

Sir,—I had resolved on not troubling you with any notice of Mr. Phillips' recent burlesque on barge and building burning at Battersea, but the subject having been brought forward by another correspondent (at page 307 of your last Number), and an allusion made to the newspaper reports of that "demonstration," permit me to notice a few facts that have been imperfectly or incorrectly reported. A small quantity of shavings was ignited (as stated by "Practice") in each apartment of a six-roomed house, and, at the expiration of *three minutes*, annihilators were simultaneously applied at back and front of the building, both internally and externally. Several men remained in the house the whole time, applying the portable annihilators, of which *eleven* were used.

Access was provided to the interior of the house by a ladder to the roof, unperceived by the bulk of the spectators.

Two powerful annihilators, in four-wheeled carriages, were placed—one in front, the other behind the building; to the first were affixed two lengths of canvas hose, terminating in two iron pipes, for directing the gas well into the interior of the building. The second machine was furnished with but one discharging hose, to which was affixed a sufficiency of iron pipes to reach to the second-floor window, into which an elbow at the end of the pipe was inserted. Just before the charge of the first machine was expended, the heat of the effluent gas destroyed both the canvas pipes, and the machine was placed *hors de combat*.

The hose of the other machine was saved from a similar catastrophe by the plentiful application of—*cold water*.

In one or two places, the flames having got hold of some woodwork, were not very easily beaten off; and a handful of fire in a corner of the ground-floor front room gave Mr. Phillips' men a great deal of trouble, and at length, turning desperate, they began pitching in a number of the carbonaceous blocks* (intended for charging the annihilators); but adding fuel to fire seemed to promise no advantage, so they at last most wisely resorted to a plentiful application of *water*, with the best results. Thus, by the application of gas, water, and by knocking out, the mimic fire was at last subdued,—forty-five minutes having elapsed from the time of ignition before the building could be safely left. Now mark the contrast between Mr. Phillips' performances and the every-day ones of the Fire Brigade:—

Mr. Phillips.	*Fire Brigade.*
Six bundles of shavings on fire were extinguished by Mr. Phillips, with two powerful annihilators, eleven portable ditto, and thirty buckets of water, in forty-five minutes.	The same amount of fire can be extinguished, with six portable engines and six buckets of water, in less than six minutes!

Your correspondent, "Practice," says that "in ten minutes a 7-inch barrel fire-engine would have put 900 gallons of water into the building." Permit me to observe, that a London fireman would have scorned to put such a machine in motion upon so contemptible a conflagration. The newspapers have taken a most indulgent view of Mr. Phillips' exertions; at the same time they justly observe, "that while the invention is well adapted for special circumstance s it would avail little or nothing against a large and open conflagration." And again, "Mr. Phillips had the advantage on Tuesday of *making his own fire*, and

* A most unaccountable piece of stupidity, as the required gas is not evolved by combustion—only by the chemical action of acids.

disposing of the combustible materials at his discretion; and though no unfairness can be alleged against the experiment, it is impossible not to see how differently matters might turn out in a *bonâ fide* conflagration."

Mr. Phillips was, apparently, more successful with the barge experiment; here, indeed, he could hardly fail, for such a fire as he acted upon would have been *self-extinguished* by simply closing the hatches. Had the tar-barrels, treacle-tubs, &c., become thoroughly ignited —that is, had the flames been permitted to extend beyond the surface, and shavings, so as to attain that state of active incandescence, which in practice (in ship fires especially) gives so much trouble, and proves so difficult to deal with—in that case I unhesitatingly assert that the annihilators would have proved useless.

Scores of such fires as Mr. Phillips had to deal with are extinguished every week with a bucket or two of water, and thought nothing of. A cargo of coals or cotton on fire, is another thing. Such fires generally spread from an incandescent centre.

Upon the last occasion Mr. Phillips had plenty of materials and men, and managed every thing his own way, yet he failed to convince the spectators (who were very numerous) that there was anything *practically useful* in his plan. The result of this field-day was so unsatisfactory, that we cannot look for many repetitions of the "*sham fight*."

In conclusion, permit me to bear testimony to the truthfulness of the remark in your last,—that for extinguishing fires all that is wanted is, "Presence of mind, *and a little water skilfully applied.*"

I remain, Sir, yours, &c.,

WM. BADDELEY.

29, Alfred-street, Islington, Oct. 23, 1850.

COMPARATIVE ELASTICITY OF WROUGHT AND CAST IRON.

The mean ultimate resistance of wrought iron to a force of compression, as useful in practice, is 12 tons per square inch, while the crushing weight of cast iron is 49 tons per square inch; but for a considerable range, under equal weights, the cast iron is twice as elastic, or compresses twice as much as the wrought iron.

A remarkable illustration of the effect of intense strain on cast iron was witnessed by the author, at the works of Messrs. Easton and Amos. The subject of the experiment was a cast iron cylinder 10⅝ inches thick, and 14¼ inches high, the external diameter being 18 inches.

It was requisite for a specific purpose to reduce the internal diameter to 3½ inches, and this was effected by the insertion of a smaller cast iron cylinder into the centre of the large one; and to insure some initial strain, the large cylinder was expanded by heating it, and the internal cylinder being first turned too large, was thus powerfully compressed.

The inner cylinder was partly filled with pewter, and a steel piston being fitted to the bore, a pressure of 972 tons was put on the steel piston. The steel was "upset" by the pressure, and the internal diameter of the small cylinder was increased by full three-sixteenths of an inch; *i. e.*, the diameter became $3\frac{11}{16}$ths of an inch! A new piston was accordingly adapted to these dimensions,—and in this state the cylinder continues to be used, and to resist the pressure; the external layer of the inner cylinder was thus permanently extended $8\frac{1}{10}$ths of its length. In fact, it can only be regarded as loose packing giving no additional strength to the cylinder.

Under these high pressures, when confined mechanically, cast iron as well as other metals appears, like liquids, to exert an equal pressure in every direction in which its motion is opposed.—*Clark's Britannia and Conway Tubular Bridges.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING OCTOBER 25TH, 1850.

WILLIAM MACALPINE, of Spring Vale, Hammersmith, general dresser, and THOMAS MCALPIN, of the same place, manager. *For improvements in machinery for washing cotton, linen, and other fabrics.* Patent dated April 23, 1850.

This washing machinery consists of a revolving vessel or tub, into which the goods to be washed are placed; immediately over this vessel is a revolving shaft carrying a number of tappets, which cause a set of stampers or beaters successively to rise and then drop upon the materials to be washed; the revolution of the vessel or tub causing a constant change of the surfaces presented to the beaters.

Claims.—1. The combining of the wash vessel with the beaters.

HENRY RITCHIE, of Brixton, Surrey. *For improvements in the manufacture of copper, brass, and other tubes or pipes.* Patent dated April 23, 1850.

These improvements consist principally in the employment of oscillating grooved

rollers for elongating or drawing out tubes or pipes formed of copper or brass. Both upper and lower rollers are made to revolve at the same surface speed, and the grooves formed in them are of a gradually increasing size from a certain point. At their smallest part the grooves form an aperture of the diameter of the finished size of the intended pipe. The casting from which the pipe is to be drawn or rolled is produced in the first instance of a tapering form, and the taper end is introduced into the wider part of the grooves. The rollers are then put in motion, so as to produce part of a revolution in one direction; the motion is then reversed. The pipe under process of formation is at each successive half revolution advanced between the rollers, until the whole length has been reduced to the intended size. By means of these oscillating rollers, pipes increasing in thickness from the ends towards the middle, or having thickened parts upon them, may be formed.

Claims.—1. The mode of elongating cast copper, brass, and other metal tubes or pipes, by rolling surfaces caused to alternate in their rotation.

2. The making tubes with seams, as above described.

PETER ARMAND LECOMTE DE FONTAINEMOREAU, of South-street, Finsbury. *For a new and improved mode of conducting, consuming, and disengaging smoke from its deleterious compounds.* (Being a communication.) Patent dated April 23, 1850.

This invention has first for its object the formation of flues or conduits below the ground and underneath the streets of a city, through which the products of combustion from every house are to be conveyed to some place to be subsequently treated and acted upon.

2. A particular construction of pipes or flues, through which the smoke from every room in a house may be conveyed into the street conduits, and wherein the smoke may be partly freed from its soot.

3. The formation of a general receiver, wherein the products of combustion passing along the street conduits, may be operated upon: this large receiver is to be placed at the bottom of a tall shaft or chimney.

4. The employment of machinery, which consists principally of a large water-mill wheel for lifting, spreading, and throwing about fluids employed to act upon the gaseous products from the conduits.

5. A method of consuming that portion of the smoke which has escaped from the previous processes, by means of a large fire placed in the upper part of the shaft or opening for the general escape of the purified gases or products of combustion.

WILLIAM EDWARD NEWTON, of Chancery-lane, Middlesex, civil engineer. *For improvements in casting type.* (Being a communication.) Patent dated April 23, 1850.

These improvements in casting types consist of certain machinery added to the pot or bath in which the molten type metal is contained, and whereby the formation of the type is effected. The principal parts of this machinery are, a plunger or piston which forces the molten metal out of a chamber in the matrix or mould; a nipple or valve, which successively opens and closes the communication between the chamber and the matrix; two cam wheels, one of which raises and depresses the plunger, the other produces the movement of the nipple. The opening and closing of the mould is produced by a revolving shaft, the movements of which coincide with the plunger and nipple.

Claims.—These various parts, as also their general arrangement.

ABRAHAM MOSES MARBE, OF Birmingham, chemist. *For an improved manufacture of vegetable fluid to be used in the production of artificial light, and in lamps or burners for consuming the same, which vegetable fluid is also applicable to the manufacture of lacker or varnish.* Patent dated April 18, 1850.

This invention has for its object the production of an inflammable fluid which shall give a good light without so dense a smoke as is produced by the combustion of unprepared hydro-carbon, and possessing also the advantage of not forming a crust like the spirit now in use.

For this purpose the patentee proposes to employ various hydro-carbons,—such as wood-tar spirit, oil of turpentine, native naphtha, coal-tar naphtha, and the naphtha obtained from bituminous substances; all of which are first purified, and then mixed with alcohol, or pyroxylic spirit in certain specified proportions.

Wood-tar spirit and oil of turpentine are both purified by adding to each gallon thereof a pound of sulphuric acid, and a quart of water. After standing two or three hours, the clear liquor is decanted into a vessel containing water, by which the remaining acid is separated from it, and a suitable vessel being then prepared, containing for every gallon of liquor a quarter of a pound of ground or pulverized lime, the whole is to be poured gradually in and stirred together. After settling, the supernatant liquid is to be drawn off by taps placed at different heights in the side of the vessel. In this state the hydro-carbons may be used instead of camphine in lamps of the ordinary description; but in carrying out this

invention it is requisite that a certain quantity of alcohol or pyroxylic spirit should be added. To deprive the hydrocarbons of the water which they contain, they are submitted to the following process:—A vat is prepared in which are placed a quarter of a pound of pulverised lime, and half a pound of calcined potash to every gallon and a half of the spirit. At the first and each successive wetting a vapour arises, which must be allowed to subside before more alcohol is added, as by pouring it in gradually the proper action of the lime and alkali will be ensured. To the alcohol thus treated is added one gallon of purified hydrocarbon, and on distilling the mixture an inflammable fluid will be produced suitable for illuminating purposes.

Naphtha is purified with nitric instead of sulphuric acid, in the proportion of half a pound of acid and a quart of water to the gallon, and when purified, one gallon and a half to the quantity of alcohol obtained in the second process.

The patentee observes, that when sulphuric acid is employed the product is a colourless fluid, but that nitric acid imparts a brown tinge. Other acids,—such as nitromuriatic and nitrous, and other alkaline substances, may be used; and he states that he does not intend to limit himself to the exact proportions given, which may in some cases require to be varied. He also observes, that he does not claim the mixing of alcohol or pyroxylic spirit with hydrocarbons, except for the purposes of his invention, such mixing having been previously practised.

The rectified spirit produced by distillation may be used instead of alcohol, and in a similar manner in the manufacture of lacker and varnishes.

Various modifications of the treatment of hydrocarbons when mixed in certain proportions are also described, in some of which the purification is effected by nitromuriate of tin, and in others by nitrate of iron.

The improved "lamps and burners" are intended to be used for consuming the rectified spirit, and descriptions are given of a wall and table lamp, chandelier, ship's light, lanthorns, &c. The principle is however much the same in each case, the spirit being supplied by capillary action, and burnt either in a partially vaporized state, or as customary in spirit lamps. For lighting burners of the first class, an instrument is employed consisting of several thicknesses of wire gauze attached to a handle; when dipped in some imflammable matter this holder retains a sufficient quantity of heat to partially vaporise and ignite the spirit; to prevent any drops from falling from this instrument on the table, a cup is placed round the wick to receive them. The burners described are applicable only to lamps for consuming the rectified spirit prepared according to this invention; but as before observed, if it is desired to use the prepared and purified hydrocarbon previous to distillation, spirit lamps of the ordinary construction are stated to be fully equal to the purpose.

Claims.—1. The manufacture of a fluid suitable for illumination from hydrocarbons, alcohol and pyroxylic spirit, treated and purified with acids, lime and alkaline substances, and distilled together, as described.

2. The manufacture of a fluid suitable for illumination from hydrocarbons purified and treated with acids, lime and alkaline substances, as described.

3. The production of a fluid suitable for illumination from hydrocarbons purified and treated with nitro-muriate of tin, as described.

4. The production of a fluid suitable for illumination from hydrocarbons purified and treated with nitrate of iron, as described.

5. The production of a fluid suitable for illumination from hydrocarbons purified and treated with nitro-muriate of tin, or nitrate of iron, either alone or in combination with naphtha or oil of turpentine, or alcohol, or pyroxylic spirit, as described.

6. The employment of the fluid produced by the distillation of hydrocarbons treated and purified as above described, in the manufacture of lacker or varnish; and

Lastly, The adaptation of lamps and burners, as described and shown to be used with the prepared and distilled fluid manufactured by means of the processes described.

William Buckwell, of the Artificial Granite Works, Battersea, civil engineer, and George Fisher, of the Taff Vale Railway, Cardiff, civil engineer. *For improvements in the construction and means of applying carriage and certain other springs.* Patent dated April 18, 1850.

The carriage springs here patented are constructed in the form of ellipses, thickened at the ends (either by additional metal at these points, or by affixing two or more plates), and fixed so as to bear loads applied at right angles to their transverse diameter, or in the direction of the tension of the metal. According to this system springs, one-tenth the weight of those constructed as at present in the form of a segmental pliable beam, will bear an equal load or loads in cwts. equal to the square of their weight in lbs. In actual practice, the patentees however prefer to allow one-half only of this weight. Thus, a load of 10 tons nett will be safely

supported by four springs, each 10 lbs. weight, which would have required springs of 400 lbs. weight, when constructed by the ordinary method. The dimensions given for such springs are—conjugate diameter 18 inches; transverse diameter 11 inches; width of plate 2 inches; thickness, three-sixteenths.

Double this thickness will be required if the load be applied at the side of the elliptical spring, which would then require to be thickened instead of the ends, as in the former case.

Springs of this construction are also applied as traction and shunting springs; one central buffer only being used, and the springs connected by a draw-bar slotted at each end to allow of its coming home against the spring at either end.

Claim.—The construction and application of springs, as described.

John Dove Harris, of Leicester, manufacturer. *For improvements in the manufacture of looped fabrics.* Patent dated April 18, 1850.

These improvements resolve themselves into a peculiar mode of manufacturing braces and other like articles, such as are required to be narrower in one part than another. This contraction has hitherto been effected by sewing the material transversely, and then drawing the thread, so as to give a closer texture to that part of the brace intended for receiving the teeth of the buckle; but Mr. Harris proposes to fit an additional cut of wheels to the machines used by him, and which are of the description termed "grinders," so that after the machine, by its ordinary working of two laps and a press (every other press being prevented by the knocking-off wheel), has produced a sufficient length of material to form the body or wide portion of the brace, on bringing the second wheels into gear the knock-off wheel shall be put out of action, and narrower work shall be produced of a closer texture, and of the description technically known as "lap and press," but containing the same number of warp threads as the wider portion.

Mr. Harris states, that he does not intend to restrict himself to the manner of working detailed by him, as the racking of the guide-bars may be varied, and the same effect produced; but he claims the manufacture of looped fabrics having one part narrower than the other, in warp machines, from the same number of warp threads, such fabrics being suitable for braces and other articles which are required to be narrower in one part than another.

William Hargreaves, the younger, of Bradford, York, ironfounder. *For certain improvements in the means of consuming smoke, parts of which improvements are also applicable to the generating of steam.* Patent dated April 18, 1850.

This specification is divided into three different heads, under which two separate improvements are described and claimed, and a third being the joint result of the other two.

1. A better consumption of smoke is proposed to be effected by arranging the bars, so as to leave very little space between them, and supporting them on arms attached to a cranked lever, by means of which a traversing motion, lengthwise, is imparted to them. A projection on the end of the bed serves as a feeder, and forces coal, with which the hopper at the furnace mouth is kept constantly supplied, over the plate from which it is received on the bars, and by their oscillating movement evenly distributed over their whole surface—an effect which is aided by giving the bed a slight incline inwards. As the coals are reduced to ashes, they are forced by the bed over a bridge at the further end into the ash-pit. The hopper mouth is opened by a rack and pinion, worked by a crank movement, and a hand-winch and chain are employed for elevating the door of the furnace.

2. To facilitate the generation of steam, hollow tubes or pipes are arranged over the furnace bars, and supplied with water from feed and side pipes in connection therewith. These tubes are cranked, so as to pass over the fire from side to side at regular intervals, and connected to side pipes, which again communicate by feed pipes with the boiler placed above, so that there is a constant and uninterrupted flow of water between the boiler and the cranked pipes, which, being imbedded in the fire, quickly raise to a boiling heat the water therein contained. They also assist in facilitating the grinding of the coal fed in.

3. The patentee insists finally on the economization of fuel resulting from the complete combustion of the coal and gases evolved, by which an increased effect is obtained from a given quantity of coal, both as regards the consumption of smoke and generation of steam.

Alfred George Anderson, of Great Suffolk-street, Southwark, Surrey, soap manufacturer. *For improvements in the treatment of a substance produced in soap-making, and its application to useful purposes.* Patent dated April 20, 1850.

In preparing alkaline ley for soap-making, there is produced a sediment, known by the name of "soaper's waste ashes" or "soaper's waste," which has been hitherto considered and treated as useless; in many cases the

manufacturer even paying for its removal. This sediment, however, consists principally of carbonate of lime, with a small portion of alkali, and a considerable quantity of quick lime; and from it the present patentee proposes to manufacture "whiting," or "whitening." This he effects by placing the sediment in a proper vessel, and nearly filling it with water. The whole is then well stirred together till the carbonate of lime and other matters are well held in suspension in the water, which assumes a milky appearance; and after allowing the grosser particles to subside for a minute or two, this liquor is drawn off and allowed to settle. As the quick lime constituting a part of this sediment has to be removed by washing with water, and this is a troublesome process, it is proposed to add sufficient carbonated alkali in solution to convert all the quick lime into a carbonate. After removing this alkali by washing, the residuum is to be collected and dried, when it may be used as whiting, or applied to any purpose for which carbonate of lime is suitable. The alkaline water, when drawn off, may be advantageously used in preparing fresh ley.

Claim.—The manufacture of pure neutral carbonate of lime, and the substance known in commerce as "whiting," or "whitening," from soaper's waste ashes or soaper's waste, without restriction to the above detailed method of manipulation.

Joseph John Baranowski, of London, gentleman. *For improvements in machinery for counting, numbering, and labelling.* Patent dated April 23, 1850.

Some of the most useful applications of the machinery described in the specification are—

1. Counting machines, in which a sum or amount is indicated from time to time, but not registered, as in the gas-meter index, voting box, and hand seal.

2. Numbering machines, in which the sum or amount is stamped, or both stamped and registered in passing, as in stamping machines, machines for printing numbers on cheques and their counterparts, and for printing railway or other tickets.

3. Labelling machines, in which signs are used in the place of figures or their equivalents—being any series of signs according to some known laws, such as A (100), B (200), or A, B, C, &c.

Claim.—"I do not claim as of my invention the several machines for counting, numbering, and labelling; but I claim separately and especially the particular arrangement of wheels or plates as shown, whereby the driving or prime moving wheel at all times controls the revolution, and fixes the position of every other wheel or plate in the arrangement, although it only alters their relative position suddenly at each of its revolutions. And I do not confine myself to the exact positions of the several wheels or plates, as shown, provided these peculiar characteristics and features of my invention be maintained."

John Timothy Chapman, of Wapping, Middlesex, engineer. *For improvements in apparatus for setting up ships' rigging and raising weights.* Patent dated April 20, 1850.

Firstly, The improvements which form the subject of this invention have relation to the construction of apparatus intended to supersede the dead eyes and other blocks now in general use for the standing and other rigging of vessels, and have for their object to facilitate the application of power for the purpose of tightening the shrouds and other rigging. Figure 1 is a front elevation of an apparatus constructed according to this invention, and represented as applied to the rigging of a vessel. It consists of two blocks, an upper one A and a lower one B, which may be either round, oblong, or pear-shaped, bulging outwards in front and back, and grooved on their peripheries like the wooden dead eyes now in use for the reception of the shrouds. Fig. 2 is a view of the upper block A, showing how in the lower portion of it there is formed a mortice C, into which there is fitted a small capstan D, upon one end of which there is fitted a worm-wheel E; F is an endless screw, which is fitted in the body of the block, and gears into the worm-wheel E, so that when the endless screw is made to revolve by means of the crank-handle G, it causes the worm-wheel and capstan to revolve also, although at a much less degree of velocity, but with an increased multiplication of the power applied to the crank handle. H is the shroud, and I the attachment of the lower block to the chain plate of the vessel; K K is a lanyard. One end of this lanyard is first passed through the hole L of the top block, and then secured by having a knot cast upon it, which prevents its being again drawn through the hole L; the other or free end is successively passed over or "rove upon" the grooved pullies M, M, M, and then passed twice or thrice round the capstan D. When the rigging is to be set up or the shrouds to be made tight, one person takes hold of the free end of the lanyard, which has been passed over the capstan, and another person works the capstan by means of the crank handle. By these arrangements the effective power which two hands are enabled to exert in setting up the rig-

ging is much greater than that of many hands applied to the dead eyes now in use for ships' riggings. Besides, with the help of this improved apparatus, effects are pro-

Fig. 2.

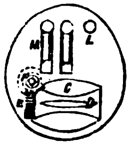


Fig. 11.

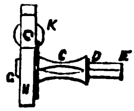
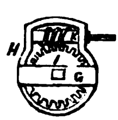


Fig. 1.

Fig. 8.

Fig. 10.



duced which could not be obtained at all by the ordinary methods. For example, a greater degree of tension can be given to the shrouds with less risk of the lanyards giving way, or of the shrouds being injured; a lanyard of smaller diameter will suffice, in consequence of the strain being equally spread over the sheaves; there are no encumbering appliances across the deck, as under the old system; the rigging may be set up during a gale or on the weather side, which has been hitherto impracticable; each pair of shrouds or all together may be set up at one and the same time, which could not be accomplished before, except on board a very full-manned ship; the rigging may be eased off or set up to meet changes of temperature and climate; and, finally, a great saving of time and labour is effected by the adoption of this apparatus—two men sufficing with its aid to set up the rigging of a large ship, which now occupies all hands.

Fig. 8 is a perspective view of a modification of the apparatus, in which the capstan is formed separate from the block, which makes it capable of being easily attached and detached at pleasure. A is the upper block; B is the lower block. Both blocks are fitted with grooved pulleys similar to those already described, and are connected by similar arrangements to the shroud and vessel. C is the capstan, which is mounted in a metal frame, as shown in the front and edge views of it given separately in figs. 10 and 11; D is a spindle, upon which the capstan is free to revolve, and which terminates in square ends, one of which (E) takes into or is "shipped" in the square hole F formed in the upper block A, while the other end carries or is attached by a cross bar G to a ring H, which surrounds the worm wheel I, and carries the endless screw K. When the shrouds are to be tightened, the end E of the spindle is shipped into the square hole of the block, and the lanyard is passed round the capstan, which is then put in motion by the crank handle L, which is continued to be worked until the proper degree of tension is obtained, when the end of the lanyard is made fast in any of the usual methods, after which the capstan is removed from the block to be applied to the other shrouds. This capstan, instead of being "shipped" in the block itself, may be mounted in some position near to the shroud block by fitting the end of the spindle E into a metal socket fixed in the rail or side of the vessel.

Other simpler forms of capstans may be used in the same manner as that represented in figs. 10 and 11, and just described; as, for instance, a wheel and pinion may be employed for the purpose of applying the power to the capstan. Or, the power may be applied directly from the winch handle to the capstan, without the aid of intermediate gearing. The spindle remains stationary

while the capstan and crank handle revolve. A still simpler construction of capstan consists in causing the spindle or axis to revolve along with the capstan and crank handle, for which purpose the end of the spindle E is made round, and takes into a socket in the block or rail of the vessel. The blocks may be formed either of wood or metal, but the capstan apparatus is best made of metal alone.

Secondly. The patentee specifies of certain improvements in shroud or purchase blocks. A pair of blocks are provided with a single lanyard or with two lanyards, and a corresponding increase in the number of sheaves and turns of the lanyards employed for tightening the lanyard. The spindle upon which the capstan is fixed has its bearings in the body of the block, through which it is passed, and projects at a short distance on each side, for the purpose of receiving the crank handles C C, by which the capstan is worked. The ordinary ratchet wheels and (E E) pauls are provided to prevent the capstan from running back during the operation of tightening the lanyard.

Thirdly. The patentee proposes in the application of the capstan apparatus or portable screw winch, represented in figs. 10 and 11, and already described, to the purpose of raising weights both at sea or on land, as, for example, raising guns, anchors, sails, casks, blocks of wood and stone, &c. In such cases, the square end of the spindle E should be inserted into a hole or socket formed in the mast or side rail, or some other convenient bearing point.

The blocks represented in figs. 1 and 2, and before described, may be also used as a portable tackle for setting up topmast rigging, or other like hoisting purposes on board ship where it is necessary to exert great power without much labour.

The patentee observes that he makes no claim to the fitting of shroud blocks or dead eyes internally with sheaves and capstans, nor to the introduction of ratchet wheels and pauls into the interior of such blocks, but that the improvements claimed are as follows:—

1. The construction of blocks for setting up ships' rigging with an endless screw and worm-wheel inserted into the blocks and worked from the exterior by a crank or winch, as before described; and also the two modifications thereof respectively, before described.

2. In apparatus for setting up rigging, the combination of blocks, or dead eyes, with a capstan apparatus (including worm-wheel, endless screw, and winch, or any equivalent means), made separately from the blocks, and attachable thereto or detachable therefrom at pleasure, as exemplified in figs. 9 and 10, and before described; and also the several modifications of such combination, as before described.

3. The peculiar construction of shroud block with interior capstan, as before described, that is to say, in so far as regards the extension of the axis or spindle of the capstan beyond the sides of the block, and the working of the same by a winch or winches applied to the outer end or ends of the spindles.

4. The application of the capstan apparatus, aforesaid, to the raising of weights, as before described.

PETER ARMAND LECOMTE DE FONTAINEMOREAU, of South-street, Finsbury. *For certain improvements in the manufacture of wafers, and in the machinery or apparatus connected therewith*. (Being a communication.) Patent dated April 23, 1850.

This specification commences with a description of the manufacture of three different sorts of wafers. Firstly. Metallic bands or strips, either ornamented or plain, are covered with paste of the description in ordinary use in the manufacture of wafers, baked, and finally cut into shape by the apparatus to be presently described. Second. These metallic bands have pasted on them strips of tissue paper, previously gummed on their lower surface, the adhesion between the metal and tissue being effected by means of suitable composition. These wafers have afterwards to be cut into shape by means similar to the first. The third description are also formed of metallic strips, having tissue paper attached to them by means of thefollowing composition, viz., sealing-wax melted at a low temperature, bees'-wax, and Venice turpentine. When the tissue is thus caused to adhere, it is coated with an adhecive mixture, and the wafers are formed by a punching machine. Wafers of the two first sorts are simply wetted, and applied as customary when used. The third sort must be first warmed, and when pressed by a seal give a perfect impression.

Should it be desired to colour the metal strips so as to resemble sealing-wax, they are coated with a paint composed of litharge and oil, and a suitable colour imparted to them by ingredients mixed with the paint. A varnish is then laid on, and they are dried in the open air.

The stamping machine is of very simple construction, and withal (apparently) fully efficient for performing the required operation. The punches are arranged in clusters, and made hollow, a strip of wafer material is placed on them, and pressure being applied from above, the wafers are cut out, and fall into a drawer underneath. When the presser plate is raised by its spiral

screws and balanced lever, the remnant of material can be removed and a fresh sheet replaced.

Claims 1. The manufacture of wafers from strips or bands of metal, or metallic alloy coated with ordinary wafer paste.

2. Baking this wafer paste in ordinary iron moulds, simultaneously with the metallic strip, thereby securing perfect adhesion between them.

3. The coating of light paper or tissue gummed on its lower surface, with slips or bands of metal.

4. Coating with a composition of wax and rosin the metallic slips, and then ornamenting them with a siccative pigment.

5. The manufacture of wafers, whether coloured or not coloured, from suitable composition covered with metallic bands perfectly representing under pressure the impression of the seal applied to them, whether sunk or in relievo.

6. The cutting apparatus, with its punches, as described.

7. The mode of soldering together a certain number of punches, as described.

THOMAS ROSS, of Coleman-street, gentleman. *For improvements in machinery for raising a pile upon woven and felted fabrics.* Patent dated April 18, 1850.

There are two machines described in this specification for the purpose of raising a pile upon linen cloth to be employed for surgical purposes, in the first of which the pile is raised by a set of revolving scrapers; in the the second, by an oscillating blade or scraper. Both machines are, however, not only essentially, but almost identically the same in every respect as those patented by Mr. W. G. Taylor for this purpose, which are referred to and described in the *Mech. Mag.*, vol. lii., pages 438 and 441.

RICHARD LAMING, of the New Chemical Works, Isle of Dogs, Middlesex, chemist, and FREDERICK JOHN EVANS, of the Horseferry-road, Westminster, gas engineer. *For improvements in the manufacture of gas for illumination and other purposes to which coal gas is applicable, in preparing materials to be employed in such manufacture, and in apparatus for manufacturing and using gas; also improvements in treating certain products resulting from the distillation of coal; parts of which above-mentioned improvements are applicable to other similar purposes.* Patent dated April 23, 1850.

The patentees claim—

1. The introduction of asbestos or fibrous silicate of magnesia among the materials used for making articles of clay intended to be used under circumstances where they are submitted to a great heat, and also the exclusive use of articles thus manufactured.

2. A peculiar and arrangement of apparatus, particularly the large funnel and double chamber and front man-hole doors, for the purpose of making gas for illumination by the decomposition of any suitable hydrocarbons or water exposed in a fluid state to the action of red-hot coke, without, however, claiming the manufacture of such gas.

3. The elongation of the eduction pipes of retorts used in the manufacture of gas for illumination, along or near their axes.

4. The production of light, in any suitable apparatus, from coal or peat gas, by heating platinum either in the form of wire or foil to a white heat, by means of which the light produced is increased in purity and intensity, and gas of inferior quality may be employed with advantage.

5. A combination of processes for making a material suitable for the purification of gas from chloride of calcium in combination with precipitated oxide of iron or copper.

6. The purification of coal gas by means of sulphate of lime mixed with sulphate of iron, or sulphate or muriate of manganese, or muriate of iron, or even sulphate or muriate of copper (by preference, however, sulphate of iron), and the employment of this mixture, when exhausted, for purifying purposes as a manure.

7. The purification of coal gas by means of a mixture composed of hydrated or precipitated oxide of iron or copper and carbonate of lime, magnesia, sulphate of magnesia, or magnesian limestone.

8. The purification of coal gas by means of chloride of magnesium or sulphate of magnesia and water diffused through sawdust, or other solid matter capable of exposing an extensive surface, saturated with these agents, to the gas, without impeding its progress through the same.

The next six claims refer also to the purification of gas, and recovery of the different agents employed for that purpose, and also to obtaining sulphate of ammonia from the mixtures used in or resulting from these purifying processes; after which the patentees go on to claim—

15. A method of manufacturing prussiates of potash, soda, and ammonia from the sulphates or carbonates of these bases, by treating them with prussiate of lime.

16. The manufacture of carbonic acid gas for converting hydrosulphate of ammonia into carbonate of ammonia, and for other useful purposes in the arts, by exposing a mixture of deutoxide of copper and carbon in powder; to a red heat, in suitable close vessels and,

Lastly. A method of treating peat to be used either for the manufacture of gas, for conversion into charcoal, or for other pur-

poses, such as fuel. The peat, as dug, is reduced in mills, in manner exactly similar to the treatment of chalk in the manufacture of "whiting." It is then mixed with water, passed through a wire sieve, which retains the fibrous portions. After being allowed to settle, the supernatant water is decanted off, and the magma collected and dried in the air, or by other suitable means, when it will be ready for use.

Specifications due, but not Enrolled.

William Henry Ashurst, of the Old Jewry, gentleman. *For improvements in the manufacturing of varnishes.* Patent dated April 18, 1850.

Peter Arkell, of Chapel-street, Stockwell, Surrey, engineer. *For improvements in the manufacture of candle wicks.* Patent dated April 20, 1850.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Jean Louis Pascal, of Moorgate-street, London, civil engineer, for an improved apparatus for the cure or prevention of smoky chimneys, and also for the ventilation of ships, rooms, and buildings in general. October 24; six months.

Thomas Beale Browne, of Hampen, near Andoversford, Gloucester, gentleman, for improvements in weaving and preparing fibrous materials, and staining or printing fabrics. (Being a communication.) October 24; six months.

Alexander Dixon, of Abercorn Foundry, Paisley, for improvements in moulding iron and other metals. October 24; six months.

John Mercer, of Oakenshaw, within Clayton-le-Moors, Lancashire, gentleman, for improvements in the preparation of cotton and other fabrics and fibrous materials. October 24; six months.

John Oliver York, of Boulogne-sur-Mer, France, for improvements in the mode or manner of generating steam in locomotive, marine, and other boilers. October 24; six months.

John Grant, of Hyde Park-street, Middlesex, for improvements in heating and regulating temperature. October 24; six months.

Aaron Rose, of Halesowen, Worcester, manufacturer, for a certain new or improved method or certain new or improved methods of manufacturing twisted gun and pistol barrels. October 24; six months.

Samuel Jacobs, of Highgate Kendall, Westmoreland, cabinet maker, for certain improvements in printing on woollen, cotton, paper, and other substances, parts of which improvements are applicable also to the purposes of colouring, shading, tinting, or varnishing such substances. October 24; six months.

Bryan Millington, of Brant Broughton, Lincoln, and of the firm of Millington and Sons, of Newark-upon-Trent, Nottingham, millers, for improvements in corn-cleaning and flour-dressing machines. October 24; six months.

Edward Clarence Shepard, of Parliament-street, Westminster, gentleman, for certain improvements in electro-magnetic apparatus, suitable for the production of motive power, of heat, and of light. (Being a communication.) October 24; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Oct. 15	2483	George Rolfe, and William Stacey	Bradford	Perforated ventilating valve cover.
16	2484	John Nurse	Crawford-street, Bryanstone-square	The cabriolet or curricle Brougham, with self-acting step-piece.
,,	2485	John Raphael Isaac	Castle-street, Liverpool	Cork or stopper.
17	2486	Gustavus Ed. Beckers	The Railway Station, Paddington	Self-acting siding stop.
18	2487	Cook and Williams	Prince's-street, Hanover-square	Respirator stock or tie.
18	2488	Cook and Williams	Prince's-street, Hanover-square	Face and chest protector.
18	2489	Susan Walker	The Grove, Hersham, Surrey	A patinette.
21	2490	William Towns, B.A.	St. John's College, Cambridge	Spirit meter.
22	2491	John Scholl	Berwick-street, Oxford-street.	Smoke consumer for gas-burners.
23	2492	George Mosley	John's-place, Grange-road	Safety pin.

CONTENTS OF THIS NUMBER.

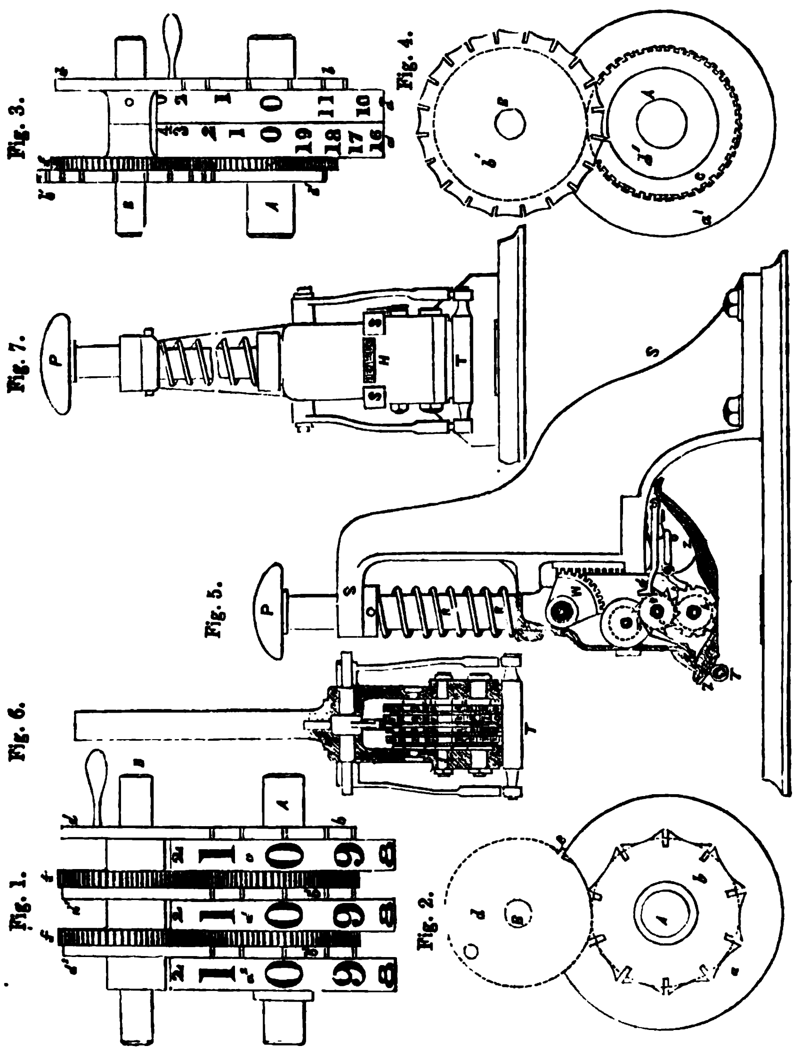
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1421.] SATURDAY, NOVEMBER 2, 1850. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

BARANOWSKI'S PATENT NUMBERING, STAMPING, AND REGISTERING MACHINE.



BARANOWSKI'S PATENT NUMBERING, STAMPING, AND REGISTERING MACHINE.

(See ante, p. 336.)

The several machines patented by Mr. Baranowski are all dependent on one particular arrangement of wheels or discs, of which he gives the following preliminary description :—

The wheels or plates d and b, fig. 2, turn on their centres B and A, and when the tooth e falls into one of the notches in b, it moves b round one-tenth of its circumference, as there are ten notches in the wheel b. The spaces between the notches in b are arcs of the same circle as d, so that b is always stationary and fixed, except when moved by the tooth in d once for each revolution of d. b is fixed to a, the edge of which is engraved with the figures from 0 to 9, as shown in fig. 1. The cogged wheel c is also fixed to a, and works into a cogged wheel of the same size f, turning on the same centre as d, the edge of which is also shown in fig. 1. d^1 is fixed to this last cogged wheel f, and is of the same form and size as d. b^1 is fixed to a^1, the edges of which are shown in fig. 1, and is of the same form and size as b. Again; fig. 1, b^2 is fixed to a^2, and is turned by d^2, which is fixed to f^1, working into the cogged wheel c^1; b^2 and d^2 are also of the same size and form as b and d. a^1 and a^2 have also the figures from 0 to 9 engraved upon their edges. All the plates or wheels move freely on their cylinders or centres, A and B respectively, although it will be seen that no one of them can move without moving all the others, at intervals of time dependent upon the number of notches in the wheels b, b^1, and b^2 respectively, and also upon their respective distances in the arrangement from the first mover d. The operation of counting proceeds thus :—The first revolution of d moves a one-tenth, or puts the unit in the place of the cypher on a; ten revolutions of d, or one of a—that is, one revolution of d^1 (for the cogged wheels are equal in size) moves a^1 one-tenth, or puts unity in the place of the cipher on a^1, or shows 10 where there is 0, 0, 0 in fig. 1. One revolution of a^1, that is, one revolution of d^2 (for the cogged wheels are of the same size) moves a^2 one-tenth, or puts unity in the place of the cipher on a^2, or shows one hundred where there is 0, 0, 0 in fig. 1, and so on till the arrangement shows 9, 9, 9 where there is 0, 0, 0 in fig. 1.

It is obvious that the notches in b, b^1, and b^2 need not be each ten in number, nor need there be precisely three such wheels; but there may be, for instance, only two (see figs. 3 and 4), b having twelve notches, and b^1 twenty notches; and in such a case, the numbers on the edges of a and a^1 might represent shillings and pounds. It will also be seen, by examining the figs. 1 and 3, that fig. 3 differs slightly from fig. 1, without affecting the peculiar character of the arrangement. The same letters show the same parts in both figs. b, the unit wheel a, and d^1 are all fixed to the axle A, which turns upon its centres. In fig. 1 the corresponding wheels are loose on A; d^1 works into b^1, as in fig. 1; and as f is fixed to b^1, and c to a^1, and f and c are of the same size, and work into each other, every complete revolution of a is attended with a partial revolution of a^1 through a space measured by the distance between any two notches in b^1, fig. 4. The object of this variation in the figs. 1 and 3 is to bring the numbers on the edges of a and a^1 close together.

Again; if d had two teeth, two notches of b would be moved round at each revolution of d, and the odd or even numbers on a would be presented from time to time where there is now 0 0 0 fig. 1, according as the arrangement was started with 1 or 2. If started with 1 it would skip 2, 4, 6, &c., and show 1, 3, 5, &c.,; if started with 2, it would skip 1, 3, 5, &c., and show 2, 4, 6, &c. The Roman method of notation, or any other signs or symbols expressive of numbers, can be substituted for the Arabic figures, and can, by means of this arrangement (modified so as to facilitate and vary its application), be made to appear at 0 0 0 (fig. 1.)

The manner in which this simple and ingenious arrangement is applied to the numbering, stamping, and registering railway tickets, (for example,) is thus described :—

Fig. 5 is a sectional view of the side of a machine of this description. R R is a cylinder which is moveable up and down in the frame S S. The top P upon which the blow with the hand is to be given, is always kept up some distance above S S by a spiral spring upon R R. The whole of the machinery forms part of R R, and moves up and down with it except the rack X, and the clicks b and d, which are fixed to S S. When R R is struck down, a tooth of the wheel c passes beyond b, and when R R rises again to its place, the wheel c is turned one tooth by the position and resistance of b; d is a click to keep c fixed, as R R descends. The arrangement here is the same as shown in fig. 1, only there are four wheels with figures on them instead of three, as the number shown is any short of ten thousand. There

are also two sets of figured or marked wheels, one above the other, and made to move at the same time by the cogged wheels on the middle axle *g* figs. 5 and 6. On the lower set the numbers project to be used as stamps, the neighbouring parts being cut away as shown in the wheel *h*, fig. 5. The upper set appear at H, fig. 7, so that each number from time to time is both stamped and registered. The segment of a wheel W, fig. 5, to which is fixed an arm carrying a small elastic roller T, works into the rack X, and at each descent of R R is thereby carried over the underside of the apparatus Z Z, and this surface being charged with printing ink, the roller T inks each projecting figure before it reaches the paper below.

SCIENCE AND COMMON SENSE.

Sir,—Your correspondent, Mr. Rock, jun., is a valorous person, whatever may be said for his discretion. He comes forward again and again as the champion of "common sense;" but he appears to vapour too much at random, to entitle him to the appellation of a true knight-errant.

One would be led to think, from the shape in which Mr. Rock, jun., and others of his class of philosophers, put the question, that science was something *antagonistic and directly opposed to common sense*, and that mathematical science was a bugbear especially to be dreaded, as the most pernicious mental poison, by those who cultivate their common sense;—in short, that in entering upon the study of Euclid, a man took leave of all those faculties which God had given him in common with his fellow men! Else, why that obtrusive and insulting bitterness that invariably forms an ingredient in every such discussion, which is manifested by this class of philosophers?

Before I proceed further, I must notice one important *hiatus* in the papers of Mr. Rock, jun.:—*the want of a complete, a sufficient, and a properly limited definition or description of common sense.* He will tell us, most likely, that "he means by it what everybody else means;" and when we apply to "everybody else," we shall be told that this multiform personage means by it "what Mr. Rock, jun., means." But we want it described in *words*, so that no mistake shall arise from this source—the most fruitful of all sources of "shuffle" in matters of reasoning. He tells us, indeed, what HE THINKS mathematical and logical science are—"*the result of an attempt to reduce common sense to rules*" (the emphatic italics are his own, and must be intended to direct specific attention to that part of his statement); and then he proceeds to sum up, in what he calls "one word, *method*—a method of thinking, or of recording thought" (p. 310, col. i.); and he finally assigns to science the function of "recording the process" which common sense has devised, so as to "facilitate its repetition" (*ib.* col. ii.) Science (not mathematical alone, but *all* science) is thus reduced to the condition of an amanuensis to common sense—a mere "recorder," at, we may suppose, the wages of a lawyer's clerk, and with pretty nearly the same functions as the laundress's boy who writes a good hand, and is taken (as a special favour, and in reward of the "nice getting-up" of his lawyership's linen) "into the office." But, after all, this is pretty much the way in which England rewards her scientific sons—except they happen to have a little "common sense" (*e.g.*, cunning), and their discoveries can be turned to *immediate commercial advantage.* However, we have at least the high authority of Mr. James Rock, jun., that these things are as they should be: the poor wretches, whom a future age may deem to have been martyrs, are placed for the present in their proper category, and such as he will exclaim—"sarves 'em right!" The business of science is *to record the discoveries* of common sense! Let not this be forgotten; but let it not be forgotten, too, that we want to know something more of this important personage, Common Sense, than Mr. Rock, jun., has yet told us.

Does Mr. James Rock, jun., mean by common sense, the common sensitive faculties (sight, hearing, &c.), or the natural power of drawing inferences from things simultaneously perceived to exist? Does he mean the vividness of perception, or the rapidity of inference displayed by the untutored mind? That either of these, so strikingly diversified

as we see them, should be deemed *common*, in any other sense than as that most persons possess a small, and a few a large, share of them, is what I cannot understand. If they be not common in *degree* as well as *character*, the name is ill-bestown. It is, however, a very common sophism, resorted to by the Rock-class, to sometimes mean one and sometimes the other, just as it suits their quibbling purpose to make a change. For this reason I ask—nay, demand—a definition of "common sense."

Mr. James Rock, jun., gives a very magniloquent, but to me very unintelligible, statement, respecting "specific difference," and "a wider generalisation." I have been familiar with these terms, in their ordinary usage, for many a long year; but I am unable "to make head or tail" of the meaning of this extraordinary passage; but having for all those years been a humble votary of science, I must, I suppose, have become incapable of understanding the common-sense language of Mr. James Rock, jun., even if I ever was blest with a single grain of that inestimable article. I have tried it in connection with what Mr. Rock says afterwards in his letter, but with the same result—its meaning being still a mystery.

Mr. Rock is great upon "method"—the discrimination of methods—the better method and the worse method—his own method and other people's methods. He would have the value of methods tested by "the goodness of the work produced by them." I must take shame to myself, but I must own it, that I am profoundly ignorant of the "work" done by this gentleman; and I regret it the more, inasmuch as it would have been an instructive study to compare it with the works of men who are not ashamed to own to science, and even to claim "the lion's share" of that commodity, though so much despised by the self-elected champion of "common sense." *Mathematical science* it is, be it remembered, he means; for in conclusion of his sentence, he *elegantly* asks—"How long is it since chemistry scraped acquaintance with mathematics?" But to proceed.

"Let it (mathematical science) be employed as an *accessory*," says he, "not as a *principal*. When a thing has been thought or done, let *science record the process*, and *thus* facilitate its repetition. TO DEDUCE FORMULA FROM EXPERIMENT IS ITS LEGITIMATE USE!" What will Mr. James Rock, jun., say when he is told that, instead of being the legitimate use of mathematical science, it is not even a use that can be, or ever will be, made of it? The formation of empirical formulæ—the "legitimate use" of mathematics! In what book has he found this confusion of ideas? I know of none, and hence infer that Mr. James Rock's "common sense" is not quite so free from opaque spots as he fondly assumes it to be. The legitimate use of mathematics, let me inform this gentleman, is to deduce the properties of figure and number; its application to physics at all is only collateral, and forms no part of the essential and fundamental objects of the science. It has been *adopted* by the physical inquirer, because he found it afforded him aid in his researches; but physical science was not taken under the wing of mathematics for the sake of affiliating or legitimatizing it. It was the *physicién* who sought the aid of mathematics — not the mathematician who sought the aid of physics. Physical inquirers as well as mechanics may (and often do to a great extent, though not so much as they think,) reject the aid which others of those classes seek. That is a matter for their own convenience, understanding, or special subject to decide upon; but, in general, those inquirers who do not invoke the aid of mathematics, are those who do not possess the "spell of invocation"—those who, from *ignorance of the science, can form no idea as to how it is to be used.*

As Mr. Rock has mistaken the functions of mathematical science in the aid she offers to physical inquirers, it may be as well to state what those functions really are. It is neither more nor less than to *deduce the consequences of any assumed law of force by which bodies act on each other*—or, if it will be more intelligible under this form, *the consequences of any physical hypothesis.* Then comes the business of the experimentalist and the observer, to ascertain whether these consequences are fulfilled, and hence decide upon the truth of the hypothesis itself. The business of the mathematician, strictly speaking, ends where that of the observer begins: though it often happens that even in the conduct of the observations themselves, the mathematician is able to afford

important aid—especially by the subsidiary contrivances he may make for facilitating the reduction of the observations to a manageable form. This, however, is incidental. In mechanism again, the business of the mathematician is to *predict* the result of any proposed combination of geometrical operations. It neither is based upon, nor requires, the slightest amount of experiment; but it *supersedes the necessity for experiment* altogether. The mechanists of the school of Mr. Rock may, if they please, get the same results by experiment,—or half by guess, and the other half by experiment, if it so please them: but he who understands how to apply mathematics to such a purpose, may justly value the greater facility with which he can decide the question on paper. All I wish here is simply to express *what really are* the proper functions (or "pretensions," as Mr. Rock so insultingly terms them), of mathematical science when its aid is sought by the physical inquirer or the mechanist.

It is, indeed, true enough that there are plenty of persons calling themselves mathematicians, but whose title to the character is as dubious as in that of many claimants to common sense to the character they assume. Pretensions *for* mathematical science may be put forward by these persons, on the same ground as their pretensions *to* it. Still these are far more rare than the cases where all the common sense in the world is arrogantly claimed by men who are innocent of science in all its (to them) hideous forms. Such arrogance rather proves the want of common sense than the sole possession of it; just as the corresponding arrogance of the *soi-disant* mathematician proves his ignorance of its principles, its character, and its functions. It is sheer impertinence and charlatanism in both cases.

Mr. Rock has recurred to the hacknied topic of the "inventive powers of the educated and the uneducated man"—of the man of science and the man of common sense. He has, it seems, to be told that the inventive faculty and the reasoning faculty are altogether distinct; and that the one may be developed very amply where the other is totally neglected. The inventive faculty is more nearly akin to the poetic than to the logical. The power of mental combination, whether of wheels and pinions, of natural phenomena, or of the words that produce agreeable or painful associations — mechanical, physical, and poetical combinations—are *acts of imagination, not of reasoning*. Reason, experiment, or taste, may step in *afterwards* to discuss their fitness; but in themselves they are purely imaginative. I believe, too, that as a general rule, the mind that is less concurrently alive to the reasoning part of the process is more likely to dash on further in breathless haste, than the mind that is better trained to heed the character of the steps it takes. It thereby arrives at results that would seldom be attained by a more cautious speculator—it invents, therefore, more frequently. But who can tell the numberless schemes thus "dashed out," that only bring disappointment and ruin to the inventor? We see only the bright side—the successful invention. Nor do we envy it; the inventor has risked much—thought much—worked much; and all these under especial disadvantages. But under these especial disadvantages, Mr. Rock would still confine himself! Advice like this is the bane of our workshops—the bane of our ablest workmen—and the bane of society too, when given with the pompous authority of this champion of Common Sense. Is it to be alleged that because a Brindley could scarcely write his name, a decent and legible calligraphy is destructive of the genius of an engineer? On the contrary, what thought the gifted, but uneducated, George Stephenson? *Feeling* the disadvantages under which he laboured, did he not give his own and only son the best education he knew how to obtain? And has that education (*scientific*, we should suppose,) rendered Robert Stephenson a worse engineer or less inventive person than he would have been, left to the dictates of his common sense? No; they alone despise and deride scientific acquirements who are themselves destitute of them. We never find a man who has made any progress in any science whatever speak desparingly of it; he knows that it gives him greater power than he would have possessed without it; and he values it accordingly. He may regret that his acquirements are limited; he may, if he be competent to judge to

that extent, regret the limits to which the science itself has been cultivated are so narrow; but he never vilifies it as useless, nor sneers at it as so inferior to what his common sense would have led him to.

We should be tempted to think from the pretentious manner in which Mr. Rock puts forward his list of mere truisms, almost "methods," that he imagined they contained some illustrious discovery. I fear he left school too early, and too early set up as philosopher on his own account. It seems he has yet to learn that philosophers of the "senior class" view science and method as one. Methods more or less perfect are only sciences more or less perfect. Every one is based upon previous knowledge, upon previously-acquired science. It is true, that a semi-idiot may imitate, as a monkey can imitate; and that a very mindless person may chatter as cleverly as a parrot. There may be, and there are, many workmen (and good workmen too at straight-forward work), who have learnt their trade without thinking of its principles: but these are not the inventors, nor are they capable of inventing. There is however a large amount of traditional science in our workshops—often, indeed, expressed with a peculiar technicality that renders it difficult for a stranger to seize its import—generally limited in its applications to some particular trade, and very imperfect and one-sided at the best. But there it is: and this it is which constitutes the science and forms the foundation of "method"—not the indefinite and hitherto undefined phantasm called "common sense." Imperfect, very imperfect indeed it is; but as far as it goes, it is to all intents and purposes SCIENCE.

I am at a loss to discover upon what particular point of Mr. Davies's "Notes," Mr. Rock fastens his strictures. I certainly thought that that gentleman went a great way in showing to what degree geometry might be carried without the aid of a technical logic; by "common sense," if I understand his critic. It is certainly a concession which no preceding geometer has made; and I suspect he will find but few who are prepared to go to the extent he does. But I leave this question to be settled between themselves; if indeed Mr. Davies shall think this "common sense" philosopher worthy of his notice. I am, Sir, &c.

JOHN LOCKE, senior.

London, October 21, 1850.

CONDENSATION BY ELECTRICITY.

Sir,—The genius of inventors has at various times been exercised in endeavouring to produce air and gas motive power. Some of these inventions have been partly successful, but the chief cause of failure has, I believe, been occasioned by the slow or bad conducting power of the aërial fluids themselves. With the object in view of pointing out to future experimentalists a means by which this defect may be remedied, I make the following remarks:

Some time since in experimentalising on the electric state of the atmosphere, I employed for that purpose a large glass cylinder, about 18 inches high, and 9 in. diameter, open at bottom, and having a neck at top. In placing the lower end of this cylinder in water, the more perfectly to exclude the air, and allowing small quantities of tobacco-smoke to enter the neck at top, the smoke, after assuming various actions, according to, probably, the hygrometric state of the atmosphere, would gradually spread itself into a cloud filling the cylinder, and at length, as successive portions came in contact with the sides of the cylinder, condense. Sometimes half an hour would elapse before this effect took place. It now struck me, that if I brought a wire from an electrifying machine into the neck of the cylinder the air would immediately become charged with electricity, which would cause each portion of smoke to fly to the sides of the cylinder, and that thus more rapid condensation would take place. The effect produced was perfectly magical; the slightest turn of a small electrifying machine produced immediate condensation. It was astonishing to see how small a quantity of electricity produced a most powerful effect.

I am not aware that attention has ever been drawn to this subject; and the question will probably arise, has electricity any thing to do with the condensation of steam in the condenser?

Believe me, Sir, to remain,

Your faithful servant,

C. F. GUITARD.

London, October 29, 1850.

MR. WILKINSON'S PROOF THAT MR. BILLS'S FORMULA FOR CUBICS (ANTE P. 252) IS ONLY AN ADAPTATION OF MURPHY'S FORMULA.*

Adopting Mr. Bills's notation, we have

$$a_1 = \frac{a}{3};\ b_1 = \frac{b}{3}.$$

$$A = b_1 - a_1^2 = \frac{b}{3} - \frac{a^2}{9} \ldots\ldots B = \frac{ab}{18} - \frac{c}{2}.$$

$$C = \frac{ab}{18} - \frac{c}{2} + \frac{3\,ab - a^3}{27} = \frac{a}{3}\left(\frac{b}{2} - \frac{a^2}{9}\right) - \frac{c}{2};\ \text{whence } C^2 =$$

$$\left\{\frac{a}{3}\left(\frac{b}{2} - \frac{a^2}{9}\right) - \frac{c}{2}\right\}^2;\ \text{or } \left\{\frac{c}{2} - \frac{a}{3}\left(\frac{b}{2} - \frac{a^2}{9}\right)\right\}^2 \text{ indifferently.}$$

$$D = (C^2 + A^3)^{\frac{1}{2}} = \left\{\frac{b^3}{27} - \frac{a^2 b^2}{108} - \frac{a^3 c}{27} + \frac{abc}{6} + \frac{c^2}{4}\right\}^{\frac{1}{2}}$$

$$= \left\{\frac{c^2}{4} - \frac{ac}{3}\left(\frac{b}{2} - \frac{a^2}{9}\right) + \frac{b^2}{27}\left(b - \frac{a^2}{4}\right)\right\}^{\frac{1}{2}}$$

$$E = (C + D)^{\frac{1}{3}} = \left[\frac{c}{2} - \frac{a}{3}\left(\frac{b}{2} - \frac{a^2}{9}\right) + \left\{\frac{c^2}{4} - \frac{ac}{3}\left(\frac{b}{2} - \frac{a^2}{9}\right) + \frac{b^2}{27}\left(b - \frac{a^2}{4}\right)\right\}^{\frac{1}{2}}\right]^{\frac{1}{3}}$$

$$F = (C - D)^{\frac{1}{3}} = \left[\frac{c}{2} - \frac{a}{3}\left(\frac{b}{2} - \frac{a^2}{9}\right) - \left\{\frac{c^2}{4} - \frac{ac}{3}\left(\frac{b}{2} - \frac{a^2}{9}\right) + \frac{b^2}{27}\left(b - \frac{a^2}{4}\right)\right\}^{\frac{1}{2}}\right]^{\frac{1}{3}}.$$

Now

$$x = E + F - \frac{a}{3} =$$

the identical formula given by Murphy, at page 51 of his "Theory of Equations."

Dear Sir,—I hinted to you, in a former note,† that an imperfect verification had led me to conclude that Mr. Bills's "New Method for Solving Cubics" was merely an adaptation of Murphy's formula for a complete cubic. I have since completed the process, and forward it for your inspection. You are at liberty to make any use you think proper of the verification.

Yours ever truly,

To JAMES COCKLE, Esq. THOS. T. WILKINSON.

ORIENTAL AND AUSTRALIAN STEAM NAVIGATION.

The importance of establishing steam communication between this country and Australia is admitted on all hands. The residents in the colony and the parties at home connected with Australia cry out for it; the Legislative Council at Sydney vote a grant in aid for it; the authorities in Cannon-row and Leadenhall-street acknowledge its importance, and profess anxiety to promote it: and yet the establishment of steam communication with Australia seems an event as far off as when the question first began to be agitated. The correspondence between Government and the East India Company respecting the Australian and Indian mails shows that it is at a dead stop. Leadenhall-street and Cannon-row are like two burly personages met in a narrow passage: neither will give way, and the thoroughfare is choked up. Who is to blame?

A brief retrospect of the history of ocean

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* From a letter to Mr. Cockle.

† This was a note from Mr. Wilkinson to me, dated Oct. 15, 1850. An observation of your correspondent "P. Q.," *sup.* p. 297, has rendered such an investigation as that contained in the above letter of Mr. Wilkinson (received yesterday) desirable.—JAMES COCKLE, Oct. 30, 1850.

steam navigation in the east is necessary to explain how Australian steam communication has come to be mixed up with the Indian mail contracts. At a late period of last session the Chancellor of the Exchequer informed the House of Commons that the East India Company stood in the way of the establishment of steam communication with Australia. Sir James W. Hogg indignantly repelled the accusation, and in corroboration of his denial moved for the production of all the correspondence that had passed between Government and the East India Company on the subject of steam communication with the East Indies, China, and Australia. In this correspondence, which extends from 1834 to the present year, will be found a brief epitome of the rise and progress of steam navigation in the eastern seas.

The real pioneer of what is called the Overland route to India was Captain John Wilson, of the Indian navy, who, prior to 1834, had made four voyages in the *Hugh Lindsay*, between Bombay and Suez. His success led to the inquiry, by a Select Committee of the House of Commons, in 1834, which ended in a recommendation by the Committee of the establishment of the present monthly mail between Bombay and Suez, the expense to be equally borne by the Company and the Home Government.

The East India Company at once signified their readiness to carry out this recommendation; but it was not till 1837 that the Home Government agreed to become liable for their moiety of the expense, and then only on the condition that they should receive the whole of the postage money. The correspondence presented to the House of Commons, in consequence of Sir James W. Hogg's motion, shows that the delay in establishing the monthly mail between Bombay and Suez did not arise in Leadenhall-street, though, if we remember aright, Leadenhall-street bore the blame of it at the time.

The success of the Great Western in transatlantic steam navigation occasioned a general demand for extended steam communication with our dependencies, and Government (wisely or foolishly—for opinions differ widely as to the policy of the step) commenced the contract system. The projectors of the Peninsular and Oriental Company obtained the contract for the mails as far as Alexandria; and, naturally anxious to carry on their passengers as far as Calcutta, they, in 1841, solicited and at once obtained from the East India Company a bonus in aid of 20,000*l.* per annum for five years, commencing from the time when they should have placed one vessel upon the station between Calcutta and Suez. The continuance of this bonus was made contingent upon their making, in the third year of its payment, monthly voyages between Suez, Madras, and Calcutta. The manner in which this bonus of 20,000*l.* per annum, for five years, was afterwards converted by Lord Ripon and Sir James Emerson Tennent into a mail contract for seven years, with a payment of 115,000*l.* per annum, and an extension of the mail service to China *viâ* Singapore, with a payment of 45,000*l.* per annum, is fully detailed in the correspondence.

By this arrangement it was decided that, for political and other reasons, the Bombay and Suez line was to remain in the hands of the East India Company, and this is the present state of our Indian mail communication—the Bombay mail, carried on by the Indian government; the Calcutta and China mails by the Peninsular and Oriental Company, with a subsidy of 160,000*l.* *per annum*, their contract expiring in 1852.

We now come to the Australian part of the question. In 1850 the Admiralty invited tenders for the conveyance of the mails between Singapore and Sydney, and, by a clause in the conditions of the tenders, it was left open to parties to offer to convey them to Sydney by any other route. Tenders were sent in, in strict conformity with the printed conditions, by the Pacific Company, offering to carry the mails to Sydney *viâ* Panama, and by the General Screw Steam Shipping Company, offering to carry them *viâ* the Cape. The Peninsular and Oriental Company also sent in a proposal to carry the Australian mails from Singapore, *provided* the Bombay and Suez line was given up to them, a new contract entered into for a line between Calcutta and Hong Kong, and 105,000*l.* *per annum* paid to them. It is from the correspondence between the Chancellor of the Exchequer and the Leadenhall-street direction, relative to these tenders, that we are left to infer who are the obstructions who retard or prevent the establishment of steam communication with Australia.

The Chancellor of the Exchequer takes no notice of the tenders *viâ* the Cape of Good Hope or Panama, but presses the East India Company to close at once with the offer of the Peninsular and Oriental Company, and pay one-half of the 105,000*l.*

The East India Company decline to accede to this proposal, on the ground that the Bombay and Suez line is necessary for the efficiency of their naval service, and that when the subject was formerly considered it had been decided that it should remain in their hands. They represent that they have

in consequence expended near a million of money in steamboats and establishments at Bombay; and that so far from there being a saving under the proposed arrangement, it would cause increased expense. Finally, they maintain that there ought to be a complete revision of the Indian contracts held by the Peninsular and Oriental Company, which expire in 1852, and public notice given as soon as possible, inviting offers for the performance of the service for a period of seven or ten years. "Unless this be done," they observe, "it appears to the Court that *there can be no competition, and a monopoly of the most extensive and objectionable character would be extended and perpetuated*, to the probable injury of the public revenue, as well as the commercial interests both of this country and India."

With regard to the Australian line the East India Directors state:—"Of the importance of that line the Court are duly sensible, and they are prepared to give suitable aid towards it upon the plan of adding a branch line from Singapore. By following this simple plan, the Court are satisfied that your wishes and those of the public would be speedily effected, whilst by mixing it up with the Bombay and Suez line (with which it seems to the Court to have no connection) the question becomes unnecessarily complicated and embarrassed, and great and indefinite delay must be anticipated." The Chancellor of the Exchequer replies, that his experience is not in favour of public competition. The correspondence ends with a reiteration of the assurance on the part of the East India Company of their readiness to pay a fair proportion of the cost of establishing steam communication with Australia; and with a letter from the Chancellor of the Exchequer to the effect, that he cannot understand their statements or apprehend their reasons.

On the face of this correspondence it appears that the Chancellor of the Exchequer and his colleagues have made up their minds that our Australian friends must be content to wait for steam communication till a complete monopoly has been established in the hands of a private joint-stock company of all the steam lines eastward of Suez. Let us now examine what they are promised in respect of vessels and speed for being consenting to such a monster monopoly.

The vessels tendered by the Peninsular and Oriental Company are:—The *Tagus*, the *Erin*, the *Braganza*, of 800 tons; and the *Lady Mary Wood*, of 560 tons. The average age of these vessels is ten years; the youngest (the *Erin*) having been built in 1846, and the oldest (the *Braganza*) in 1836. The speed they are tendered at is eight and a half knots an hour!!! How the Americans must laugh to see our Government entering into fresh contracts for a term of years with old paddle-wheel boats, crawling along at the rate of 200 miles a day within the tropics!

The conduct of the Home Government in this negotiation raises a question of infinitely wider extent and more vital moment even than that of our intercourse with Australia. It is of peculiar importance, now that our steam ascendancy on the ocean is threatened by our energetic rivals in the United States, that the public should have every means of checking anything that tends towards monopoly, as all experience has shown that our national superiority in the mechanical arts depends, not more upon the abundance and cheapness of our minerals than upon the freest possible competition in all departments of industry. Steam navigation is no exception to this universal law; and it is no more than justice to the East India Company, whose proceedings we are often called upon to criticise severely, to declare that the part they have taken in the discussion respecting steam communication with Australia has tended neither to obstruct nor retard that important object, but simply to assert the great principle of free competition and the repression of monopoly. Stripped of all specious pretences and irrelevant proposals, the real question at issue between them and the Chancellor of the Exchequer is, whether a private joint-stock company shall or shall not have a monopoly of the steam communication between this country, the East Indies, and China. The Chancellor of the Exchequer and his colleagues, who refuse to budge unless this enormous, mischievous, and unwarrantable exclusive privilege be conceded to their *protégés*, are the real obstructives on the present occasion.—*Daily News*.

HYDRAULIC PRESSES.

In most cases hydraulic presses fail by splitting vertically down the centre, and on account of the incompressibility of water, the fracture is generally quiet and gradual. In consequence of the frequency of such failures, it has been supposed by some experienced makers, that after being for a certain time exposed to so great a strain as three tons per circular inch, all cylinders will ultimately fail. There appears, however, after careful inquiry, no good grounds for this conclusion; the imperfection of the safety valve renders it at all times doubtful what pressure is actually employed; and most cases of failure may be traced to some

unusual pressure. An 18-inch press has been in constant use many years by Mr. Amos, the pressure being always three tons, and on some occasions four tons per circular inch. In some extensive works at Dover, where large hydraulic presses are used for drawing oil, five double and two single presses have been long in use; the pressure is constantly upwards of three tons; three cylinders have failed, and were all found to be defective castings; and one double press has been up 102,000 times.

Wrought iron would doubtless give perfect security; but the construction of such large cylinders (as used at the Britannia Bridge) would be next to impracticable. Brass presses are sometimes used, and the ram is sometimes successfully lined with brass to lessen the wear.

The area of the large press for the Britannia Bridge was 314·16 square inches, and the capacity with a 6-feet stroke 2216·5 cubic inches. The quantity of water employed for a 6-feet lift is therefore 81·57 gallons =815·7 lbs.

The pressure at three tons per circular inch =3·819 tons per square inch, which would raise a column of water 5·41 miles in height; this pressure would therefore be sufficient to throw water over the highest mountains on the globe. The ratio of the area of the pump to that of the cylinder is as 1:354·3.

It is evident that, instead of a force pump, a head of water may be conveniently employed for forcing water into the cylinder; and in this manner power may be stored up ready for use. The hydraulic press in this form is used for working cranes, for unloading vessels, and other purposes where a more rapid motion is requisite.

In all cases where great pressure is required, the steady character of its action adds greatly to its utility; among other uses, it is extensively employed for compressing wool and hay, to facilitate packing, for drawing oil from seeds, for drawing lead and pewter pipes, for glazing paper (commonly called hot-pressing), for raising vessels in dry docks, for raising turn-tables and swing bridges on a vertical pivot to facilitate their circular motion, for pressing metals into moulds; and, in a portable form, a small press forms a very convenient substitute for the screw-jack, and has been extensively employed in moving heavy weights during the construction of the Britannia and Conway Bridges.—*Clark's Britannia and Conway Tubular Bridges.*

SUSPENSION BRIDGES OF THE CHINESE.

The most remarkable evidence of the mechanical science and skill of the Chinese at this early period is to be found in their suspended bridges, the invention of which is assigned to the Han dynasty, according to the concurrent testimony of all their historical and geographical writers. Shang-leang, the commaader-in-chief of the army under Kaou-tsoo, the first of the Hans, undertook and completed the formation of roads through the mountainous provinces of Shense to the west of the capital. Hitherto its lofty hills and deep valleys had rendered communication difficult and circuitous. With a body of 100,000 labourers, he cut passages over the mountains, throwing the removed soil into the valleys; and where this was not sufficient to raise the road to the required height, he constructed bridges which rested on pillars or abutments. In other places he conceived and accomplished the daring project of suspending a bridge from one mountain to another across a deep chasm. These bridges, which are called by the Chinese writers very appropriately "flying bridges," and represented to be numerous at the present day, are sometimes so high that they cannot be traversed without alarm. One, still existing in Shense, stretches 400 feet from mountain to mountain, over a chasm of 500 feet. Most of these "flying bridges" are so wide that four horsemen can ride on them abreast, and balustrades are placed on each side to protect travellers. It is by no means improbable that, as the Missionaries in China made known the fact more than a century and a-half ago that the Chinese had suspension bridges, and that many of them were of iron, the hint may have been taken from thence for similar constructions by European engineers.—*Thornton's History of China.*

POUPARD'S CURVILINEAR BEAM WEIGHING MACHINE.

(Registered under the Act for the Protection of Articles of Utility. William Poupard, of 30, Wych-street, Strand, London, Scale-weighing Machine and Weighbridge Manufacturer, Proprietor.)

Fig. 1 is a longitudinal section, and figs. 3 and 4 front and side views of this improved weighing machine. Fig. 2 is a separate view in perspective of the beam.

A A is the frame. B B the beam. C C the scale plates. D D the circular centres against which the knife edges of the beam-work, E E, the levers by which the scale plates are kept in a horizontal position. F F the stay rods. G is a board for keeping the plates steady, and preventing injury to the machine, when being carried on a wagon or other-

Fig. 3.

Fig. 1.

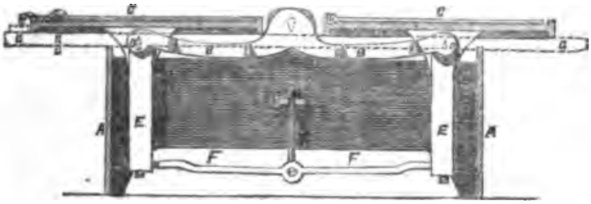
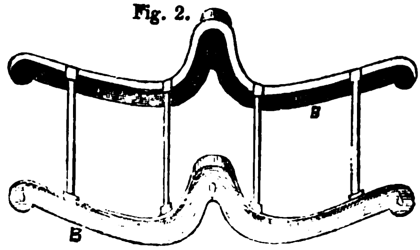


Fig. 4.

Fig. 2.



wise; it is inserted between the top of frame A and the scales CC, as indicated by the dotted lines in fig. 1.

The utility of this design results from the shape given to the beam, which being of a curved form admits of the circular centres for the knife edges being close to the underside of the scale plates, and thus throws less strain upon the levers E E.

Water—the Grand Constituent and Solvent.

Of organic bodies, whether vegetable or animal, WATER is a large constituent during life and a powerful solvent after death. Potatoes, for example, contain 75 per cent. (by weight) and turnips no less than 90 per cent. of water; which explains, by the way, the small inclination of turnip-fed cattle and sheep for drink. A beefsteak strongly pressed between blotting-paper yields nearly four-fifths of its weight of water. Of the human frame (bones included) only about one-fourth is solid matter (chiefly carbon and nitrogen), the rest is water. If a man weighing 10 stone were squeezed flat under a hydraulic press, 7½ stones of water would run out, and only 2½ stones of dry residue would remain. A man is, therefore, chemically speaking, 45 lbs. of carbon and nitrogen diffused through 5½ pailsful of water. Berzelius, indeed, in recording the fact, justly remarks, that the living organism is to be regarded merely as a mass diffused in water; and Dalton, by a series of experiments tried on his own person, found that of the food with which we daily repair this water-built fabric, five-sixths are also of water.

* * * *

The sap of plants is a solution of material matters, saline and organic, in water, which distributes them so rapidly that its upward course through the minute vessels (as observed by Lindley in the stipules of the *ficus elastica*) looks like the rushing of a swift stream. A pailful of water, suitably impregnated with salt, is speedily sucked up by the root of a growing tree immersed in it; the salts are assimilated, as is also a part of the water, the remainder being evaporated from the leaves. Food or poison may be thus artificially administered to plants; and timber is thus hardened in France, and even stained, whilst living, of divers brilliant hues. As for the evaporation from foliage, it is so abundant, that a sunflower perspires 1¼ pail per diem, and a cabbage nearly as much—nay, it appears from valuable experiments published by Mr. Lawes, of Rothamsted, that a wheat plant, during the period of its growth (172 days), exhales about 100,000 grains of water; so that, taking the ultimate weight of the mature plant at 100 grains, and its mean weight at 50 grains, which is a full estimate, its mean daily perspiration actually exceeds ten times its own mean weight. At this rate, an acre of growing wheat (weighing at

least two tons at maturity), should exhale on an average fully ten tons of water per diem.

* * * *

Of a plaster of Paris statue, weighing 5 lbs., more than 1 lb. is solidified water. Even the iridiscent opal is but a mass of flint and water combined in the proportion of nine grains of the earthy ingredient to one of the fluid. Of one acre of clay land, a foot deep, weighing about 1,200 tons, at least 400 tons are water; and even of the great mountain chains with which the globe is ribbed, many millions of tons are water solidified in earth.

Water, indeed, exists to an extent and under conditions which escape the notice of cursory observers. When the dyer buys of the drysalter 100 lbs. each of alum, carbonate of soda, and soap, he obtains in exchange for his money no less than 45 lbs. of water in the first, 64 lbs. in the second, and a variable quantity, sometimes amounting to 73½ lbs., in the third.

Even the transparent air we breathe contains, in ordinary weather, about five grains of water diffused through each cubic foot of its bulk; and this rarefied water no more wets the air than the solidified water wets the solid material on which it is absorbed.—*Quarterly Review.*

NATURAL WATER PURIFIERS.

Mr. Warrington has for a year past kept twelve gallons of water in a state of admirable balanced purity by the action of two gold fish, six water snails, and two or three specimens of that elegant aquatic plant known as *valisperia sporalis*. Before the water snails were introduced, the decayed leaves of the valisperia caused a growth of slimy mucus, which made the water turbid, and threatened to destroy both plants and fish. But under the improved arrangement the slime as fast as it is engendered is consumed by the water snai's, which reproduce it in the shape of young snails whose tender bodies again furnish a succulent food to the fish; while the valisperia plants absorb the carbonic acid exhaled by the respiration of their companions, fixing the carbon in their growing stems and luxuriant blossoms, and refreshing the oxygen (during sunshine in visible little streams) for the respiration of the snails and the fish. The spectacle of perfect equilibrium thus simply maintained between animal, vegetable, and inorganic activity is striking and beautiful; and such means may possibly hereafter be made available on a large scale for keeping tanked water clean and sweet.—*Ibid.*

ELLIOTT, THE CORN-LAW RHYMER, A MATHEMATICIAN.

Sir,—I do not remember to have seen it mentioned in any of the biographical notices which have recently appeared of Ebenezer Elliott, the Corn-law Rhymer, that he was a mathematician as well as poet. In a copy which I have of Col. Perronet Thompson's tract, intituled "The Proof of Euclid's Axiom* looked for in the Properties of the Equiangular Spiral," 1840, there are a number of emendations of a passage in the text inserted in ink, with this marginal note (of my own) opposite to them:—"These alterations were suggested to Col. Thompson by the Corn-law Rhymer, E. Elliott." I think, but am not sure, that I had the fact from Col. Thompson himself. I subjoin the passage in question, with the alterations suggested by the poet-mathematician—marking by italics the expressions which he deemed faulty, and enclosing within brackets his suggested substitutions and additions, which evince, it will be seen, no small degree of logical acumen:—

THEOREM.—*In the Circle described within any limited Radius, the Circumference is limited.*

For take *any portion* of the circumference, *however small* (any two points) as A, B, and join A and B with the centre C. Because two straight lines which are not in one, and the same straight line cannot have a common segment, an angle will be contained between CA and CB. And because any given magnitude may be multiplied so as at length to become greater than any other *given* (determinate) magnitude of the same kind which shall have been *assigned* (specified) some (limited) number of times, the angle ACB will be equal to or greater than the whole circumference *of the circle* (for each of the angles equal to ACB will stand upon a portion of the circumference equal to AB). And because the number in the first case is limited, the number in the other is. And because the number of times AB in the circumference *is* (has been thus shown to be) limited, the circumference is limited.

I am, Sir, yours, &c.,

R. C. J.

Oct. 7, 1850.

* The equality of the three angles of every triangle to two right angles.

FARTHER APPLICATIONS OF CENTRIFUGAL ACTION TO MANUFACTURING PURPOSES.

(Translated from the *Moniteur Industriel*, for the *Mechanics' Magazine.*)

It is well known that a centrifugal machine has been hitherto employed with much advantage for the drying of textile fabrics and for clarifying sugar; but these are not the only purposes to which it is adapted; for every day new applications of this apparatus suggest themselves, and important problems are solved by its means.

We now learn that one of the most important operations of brewing may be wonderfully simplified by the use of a centrifugal apparatus. It has hitherto been considered exceedingly difficult to reduce the temperature of beer to the degree of coolness requisite; it has been necessary to make use of refrigerators for this purpose, and, notwithstanding all precautions, mistakes not unfrequently happen. It occurred to some English brewers that this difficult cooling process might be effected by means of a centrifugal machine. This idea has been put in practice with complete success. The beer was reduced to the desired temperature by merely passing it through the machine; and this was effected not only with great rapidity, but also with considerable economy.

Some time back, a M. Gauthier de la Touche, of Paris, endeavoured to produce ice by means of a hydrofugal apparatus. He did not succeed in reducing water to the freezing point, but he cooled it to a degree far below that required in brewing beer.

It would be superfluous to explain these results, for every one is acquainted with the effects of a very rapid ventilation, and the centrifugal machines are made to rotate at the rate of 3000 revolutions per minute, and even quicker.

We are further informed that in certain manufactories in Alsace, a hydrofugal machine is used for making starch. When flour is stirred about in water, the different substances range themselves according to their specific gravities, (unless prevented by some peculiar circumstance.) Now this is precisely the result obtained by the centrifugal machine; starch, being the heaviest substance, separates itself from the others, and is the first precipitated.

The centrifugal machine may also be advantageously applied for classifying grain, seed, or ores, according to their respective densities, or any other substances of different densities, whether liquid or solid, provided that they are not of a cohesive nature, or that whatever cohesiveness they possess may be easily removed.

In fact, the centrifugal apparatus may be applied to so many different manufactures, that it may justly be looked upon as one of the most fortunate and fruitful inventions of modern times.

ABATEMENT OF THE SMOKE NUISANCE.

The Town Council of Manchester are pushing to a practical test their powers (under a local Act) of compelling the manufacturers to consume the smoke of their furnaces. A report of the Council's Sub-committee on the subject contains this very encouraging summary of their successes—

"In conclusion, your Sub-Committee congratulate the Committee upon the fact, that, in many instances, chimnies which were at one time the worst in the borough, and which almost incessantly emitted dense smoke, are now amongst the best; and upon the still more important and significant fact, that your Sub-Committee have obtained the favourable opinion of millowners generally as to the practicability of preventing smoke at what are termed heavy mills, and that such prevention can be secured without loss. In several instances, parties who had most strongly expressed an opposite opinion, have with evident pleasure assured your Sub-Committee that they no longer entertain any doubt as to the practicability of preventing smoke, but also that such a happy change may be attained, if not with considerable economy, at any rate without loss."

Councillor Howarth added these interesting details—

"He lately waited on Mr. Hugh Beaver, and ascertained that the quantity of coal formerly used per week in his manufactory was 78 tons, whilst by the consumption of smoke and the improvements consequent on the adoption of the system a weekly saving is effected of 28 tons. 'I visited Messrs. George Clarke and Sons' manufactory,' continued Mr. Howarth, 'and they told me the saving they effected by consuming the smoke from their fires was upwards of 40 tons per week. They formerly used 140 tons per week, now they consume less than 100 tons. They have expended upwards of 1200*l.* on new boilers to their steam-engines, in order to abate the smoke nuisance; and they expect the outlay will be repaid by the saving of coal effected in a year and a half.'"

The local correspondent of a London journal observes—

"No one who has visited this town recently, and who recollects the dense clouds of smoke which overhung the borough, but must make a very pleasing comparison in favour of the present appearance and condition of our streets; and it is not less

encouraging to find, from a statement made this morning by Mr. Councillor Howarth, that all this improvement has been effected not only without loss but to the positive advantage of the manufacturers. It is unquestionable that our manufacturers at the outset thought this Legislative interference a great hardship; indeed, when summoned before the Magistrates, it has not been unusual to urge that the mitigation of this nuisance was a delusion, and that the consumption of smoke was utterly impossible."

HISTORY OF AN INVENTOR.

We quote the following Obituary notice from the Dublin papers:—

Died at his residence, Frankfort-avenue, Rathmines, Mr. Joseph Hardy, aged 93 years. When 20 years old he invented a machine for doubling and twisting cotton yarn, for which the Dublin Society awarded him a premium of 20 guineas. Four years after he invented a scribbling machine for carding wool, to be worked by horse or water power, for which the same Society awarded hin one hundred guineas. He next invented a machine for measuring and sealing linen, and was in consequence appointed by the linen board seals master for all the linen markets in the county of Derry, but the slightest benefit from this he never derived, as the rebellion of '98 broke out about the time he had all his machines completed, and political opponents having represented by memorials to the board that by giving so much to one man, hundreds who then were employed would be thrown out of work, the board changed the seal from the spinning wheel to the harp and crown, thereby rendering his seals useless, merely giving him 100*l*. by way of remuneration for his loss. About the year 1810, as no doubt many still living will recollect, he demonstrated by an apparatus attached to one of the boats of the Grand Canal Company at Portobello the practicability of propelling vessels on the water by paddle-wheels; but having placed the paddles on the bow of the boat, the action of the backwater on the boat was so great as to prevent its progressing at a greater speed than three miles per hour. This appearing not to answer, without further experiment he broke up the machinery, and allowed others to profit by the ideas he gave on the subject, and to complete on the open sea what he had attempted within the narrow limits of a canal. He also invented a machine for sawing timber; but as it happened in too many instances to Irishmen, the result of all his inventions during a long life has been very considerable loss of time and property without the slightest recompense from the Government, or the country benefited by his talents.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING OCTOBER 25TH, 1850.

CHARLES HUMFREY, of Downing College, Cambridge, M.A. *For improvements in the manufacture of candles and oils, and in treating fatty and oily matters, and in the application of certain products of fatty and oily matters.* Patent dated April 23, 1850.

The object proposed to be effected by this patentee, is the conversion of all oils into a substance resembling sperm oil, which, as is well known, is essentially different from all other oils, inasmuch as it is not oxidized by exposure to atmospheric air. The cause of this difference has never been satisfactorily explained. "Oline," under which term all oils may be included, consists of oleic acid and glycerine (the protoxide of glycerule;) it is also bi-basic, each atom of oleic acid being combined with two atoms of the protoxide of glycerule, and hence oline is chemically the "basic olate" of the protoxide of glycerule. Referring to the law with respect to oxysalts, it is well known that the oxygen in the acid bears a proportionate ratio to that contained in the base; and if a neutral salt capable of oxidation be formed, and caused to pass from the state of a protoxide to that of a deutoxide, one atom of base will be eliminated and set free, the remaining atom combining perfectly with the acid.

Now with respect to oline, it has been hitherto supposed that absorption of oxygen produced a new acid, termed elaidic, which, combining with the glycerine, converts it into a fatty matter termed elaidine. But this theory fails to account for the invariable production of a gummy substance (the "*corps rouge*" of the French chemists.) If, however, we suppose that, by absorbing oxygen (as in the case of the oxysalts above alluded to), the two atoms of glycerine or protoxide become two atoms of deutoxide, then one atom would saturate the acid, and the other atom of glycerine, or possibly deutoxide of glycerule, be eliminated and form a gum, which would be the "*corps rouge*" above alluded to. The saturated acid would then form a neutral salt, *i. e.*, perolate of glycerine, in every respect essentially identical with sperm oil, which, from various experiments made by him, the patentee is convinced to be a true chemical per-olate of the deutoxide of glycerule.

The habits of the sperm whale are such as would account for the oxidisation of the oline contained in its food, which is almost wholly animal. This whale is furnished with air-breathing lungs, and the oxygen thus inhaled would, during the process of digestion, as is the case with all carnivorous animals, produce naturally effects similar to those which it is now proposed to obtain by artificial means.

The matters most suitable for oxidizing oline and stearine, are nitrous and hyponitrous, which possess the capability of being reoxidized by contact with atmospheric air, after surrendering their proportionate quantities of oxygen to a deoxidizing agent. If this operation be performed in a Woolf's apparatus, having its cells charged alternately with oline and atmospheric air, the deep orange-coloured fumes will be seen to change colour during contact with the

oline; then, on entering the air chamber, they recover their lost oxygen and their colour, and again surrender them to the fatty matter, and so on till the residual azote of the air becomes so bulky as to impede the operation. The eliminated atom of glycerine will be found adhering to the sides and bottom of the vessel.

Stearine, or the concrete part of animal fat, may be similarly treated with analogous results. The mixture of perstearate and perolate, formed by treating tallow, is a highly inflammable substance, harder than ordinary tallow, and capable of being without further preparation moulded at once into candles.

The first operation is practically valueless unless the eliminated glycerine be removed. This may be effected either by the use of alcohol, ether, water, pyroligneous acid, or alkaline solutions. Passing by the spirit as too expensive, the water as occupying too long a time, and the acid as being injurious to the oline; alkalies only remain available. But all alkalies, at the same time that they absorb or combine with glycerine, have a strong affinity for oline, which, under their influence, is converted into a soap. To obviate this saponification the patentee proposes to employ a saturated solution of chloride of sodium (common salt) to which is added from 2 to 3 per cent of alkalimetral caustic soda. This mixture, in a cold state, is to be added to the purified fluid oline, at a temperature of about 90° Fahr., in at least equal quantities, but it is better to have it in excess even if the proportion per cent. of alkali be reduced. Solidification to a certain extent immediately ensues, and after allowing plenty of time (say, perhaps, a day or more) the mixture is to be heated to 150° or 160° Fahr., and when it is perceived that a portion of the glycerine has begun to settle, the heat may be safely raised to the boiling point. The perolate is then skimmed or poured off, and the glycerine sets, when cold, into a firm jelly. As the perolate consists partly of solid and partly of fluid fat, they are to be separated by the methods of bagging, pressing, &c., in ordinary use. Under this part of the invention the patentee claims :—

1. The oxydizing of oline and stearine by the agency of nitrous and hyponitrous gas, alternately deoxidized by passing through the fatty body and reoxidized by contact with atmospheric air. Preferring the apparatus and mode of operation described.

2. The removing the eliminated glycerine, protoxide of glycerule or gummy matter from oline or stearine artificially oxidized by the use of alkaline solutions. Preferring the mode of operation described.

3. The combined application of the above processes to obtain pure perolate and perstearate of glycerine.

Mr. Humfrey next proceeds to observe that oline and stearic acids are susceptible of treatment similar in principle to the above; but as the products resulting from this treatment are not of such obvious utility as those obtained by preceding methods, we omit the description of the process. Under this head of his invention Mr. Humfrey claims—The acting on fatty acids by means of nitrous and hyponitrous gas alternately deoxidized by passing through the fatty body, and reoxidized by contact with atmospheric air.

When the first of the operations, before described, is performed on a scale more extensive than that of a mere experiment, the following apparatus (referred to in the claims) is recommended as applicable. A long shallow trough of pottery ware or other material, say 24 feet long, 4 feet wide, and 6 inches deep. The cover fits on airtight, and has attached to it at certain intervals partitions which are of such depth as just to dip under the surface of the oline, with which in carrying out this operation the trough is about half filled. These partitions serve to divide the trough into compartments, to each of which is fitted a pipe for supplying air, which pipe is closed at pleasure by a cock. At one end of the apparatus is a chamber for generating the gas and the other is continued upwards, and forms a shaft which is rendered partly vacuous by a jet of high pressure steam, by which gas is drawn through the whole length of the trough, alternately surrendering its oxygen to the fatty body, and receiving it again by contact with the air, which fills the upper portion of each compartment. A pump attached to the trough keeps up a circulation of the matter under operation. The patentee prefers to create a draft in the shaft, or chimney, by means of a steam jet; for which, however, other means may be substituted, such as a blower or fan.

A second branch of the specification relates to the manufacture of certain dyes and pigments from stearic, oleic, and elaidic acids, combined with suitable metallic protosalts. Thus a colour resembling verdigris (the acetate of copper) may be made from oleic acid neutralized by soda, so as to form an olate, and a neutral solution of sulphate of copper in boiling water. "Scheele's green," and "emerald green," may be also manufactured in a similar manner. When the protosalts of other metals are employed in combination with one or other of the above-named acids, various colours can be produced; care must, however, be taken

that the solutions of each are perfectly neutral. Thus salts of iron produce a beautiful mahogany brown—of zinc, a buff,—of manganese, yellow—of tin, brilliant yellow, &c.

Claim.—The treating of fatty acids with certain metallic oxides and peroxides, for the purpose of producing salts to be used as pigments and dyes.

Ernst Werner Siemens, of Berlin, Prussia, electric engineer. *For improvements in electric telegraphs.* Patent dated April 23, 1850.

Claims. — 1. The constructing electro-magnets, for telegraphic purposes, of longitudinally-divided tubes of iron or other magnetic metal, or of bundles of wire of iron or other magnetic metal.

2. The construction of instruments, for obtaining motion for telegraphic purposes by means of one or two electro-magnets revolving on their axes within the fixed coils, by which they are rendered magnetic, or mounted on a transverse axis, and vibrating from side to side within the coils, by which they are magnetized.

3. The construction of instruments, for producing motion for telegraphic purposes by means of metallic spiral coils or bands traversed by electric currents, and attracting or repelling each other; also producing motion in such spirals by the proximity of permanent magnets, which, at the same time, serve to produce electric currents by induction for working telegraphic apparatus.

4. The construction of the conducting contact pieces of alloys of platinum, iridium, or palladium with gold or silver, whether such alloys be further alloyed by the admixture of other metals or not.

5. The construction of electric telegraphic printing apparatus in such manner that the magnet which works the step-by-step motion, breaks and restores the circuit by the oscillation of the armature, or of the moving magnet itself.

6. The combining of electric telegraphic printing apparatus in the same circuit with indicating apparatus, when the magnets which work the step-by-step motion of either or both instruments break and restore the circuit by the oscillation of the armatures or of the magnets themselves.

7. The impression of the types on the paper at the instant that the type-wheel stops, by arranging the electro-magnet which acts on the hammer so that the short intermittent currents which work the electro-magnet of the type wheel traverse the coils of this magnet without producing motion of the armature, which, however, is set in motion when the current is rendered continuous by the stoppage of the type wheel.

8. The arrangement of the magnet which acts on the hammer in electro-telegraphic printing apparatus, so that its own circuit is broken by the magnet itself towards the end of its stroke.

9. The arrangement of apparatus in electric printing apparatus in such manner that the printing is effected by pressing the type against paper in contact with an inked roller.

10. An arrangement for retaining the moving piece which breaks and restores the electric circuit in its respective positions.

11. The application of a small pin for preventing the overrunning of the ratchet wheel in electric telegraphic apparatus with the step-by-step motion.

12. The arrangement of a transmitting apparatus with an indicating or printing electric apparatus, worked by step-by-step motion, or with both together, in such manner that the transmitting apparatus breaks and restores the circuit of the telegraphic apparatus, which reciprocally breaks and restores the circuit of the transmitting instrument.

13. The combination of a self-acting alarum with a transmitting apparatus.

14. The combination of a self-acting alarum with a transmitting instrument which breaks and restores the circuit of the alarum magnet, which in its turn reciprocally breaks and restores the circuit of the transmitting instrument.

15. The combination of one or two cylinders carrying pins, with a series of springs and keys for making contacts for transmitting a distinct determinate succession of electric currents in one or both directions by the depression of each key.

16. The employment of an implement of the nature of a plough, and revolving cutters for making trenches or channels to receive under-ground line wires.

17. The application of the propelling power of a locomotive engine to giving motion to such implements.

18. Conducting under-ground line wires into the ground by means of suitable guides, which either form part of, or immediately follow the cutting instruments.

19. The following improvements in the manufacture of coated wire for electric telegraphic purposes:—First, An arrangement of machinery for coating the wire, with two cylinders and pistons by which the pressure of the semi-fluid mass against the wire is equalized. Second, Arranging these cylinders (or cylinder, when only one is used) so that they may be removed and replaced by others, while the former are being recharged. And, Third, The consolidating of gutta percha, or its compounds within these cylinders in vacuo.

20. The testing of coated wire for telegraphic purposes by passing it through water with which is connected an apparatus capable of producing electric shocks, so that the circuit may include the person of the operator, and may be completed by the passage of the electricity through the defects in the coating of the wires.

21. The covering of insulated underground line wire with strips of sheet lead.

22. Establishing a direct communication between under-ground line wires and the earth by means of a thin wire of German silver, or some other imperfectly conducting substance, so that the resistance to the passage of the electricity may be capable of being regulated at pleasure.

Antoine Pauwells, of Paris, France, merchant, and Vincent Dubochet, also of Paris, France, merchant. *For certain improvements in the production of coke, and of gas for illumination, and also in regulating the circulation of such gas.* Patent dated April 23, 1850.

The patentees commence their specification by observing, that although several attempts have been made at different times to obtain and apply the gas evolved from coal during its conversion into coke, this object has not hitherto been successfully attained, owing either to the insufficiency or inefficiency of the apparatus employed, and, to a certain extent, to the formation of the ovens themselves. They then proceed to describe their improved apparatu , and claim—

1. A "pyrotechnic apparatus" constucted on the principle above alluded to, and having one or more fire-places or furnaces, with a caloric reservoir or arrangement of parts for storing the heat, and also an arrangement of flues for the circulation and distribution of the caloric—the said apparatus having for its object the simultaneous production of carburetted gas suitable for illuminating purposes, and of coke of suitable quality for the purposes of smelting metals and generating steam in locomotive engines; these operations (*i. e.*, the production of gas and coke) being aided in their effectuation by the employment of the waste (or non-carburetted) gases, or of all the gases evolved, if coke only is required to be produced.

The interior of the oven is elliptical, and the roof formed double, the intermediate space being filled with sand and constituting the "caloric reservoir."

2. The application to the "pyrotechnic" apparatus of an "extractor," its object being to protect the oven from the pressure of the gases of the atmosphere and to draw out and collect the gas either for the purpose of illumination, or to be returned to serve as fuel to the furnaces of the coke ovens.

The extractor consists of three bell-shaped chambers suspended in a vat of water. The upper portion of the chambers forms a vacuum which exhausts the gas as evolved from the furnaces. The patentees recommend that two of these extractors should be attached to each pyrotechnic apparatus, so that in the event of any accident happening to either of them, no obstruction might be offered to the continuous exhaustion and delivery of the gas.

3. Various forms of an apparatus denominated the "Moderator," which serves to equalise and regulate the distribution and flow of the gas.

Evan Protheroe, of Austin-friars, London, merchant. *For improvements in the manufacture of oxide of zinc, and in making paints from oxide of zinc.* (A communication.) Patent dated April 30, 1850.

The improvements above referred to and claimed in the specification, are as follows:

1 and 2. An arrangement of apparatus, consisting of a reverberatory furnace, in which the zinc is melted, and two retorts, in communication with each other, into which the metal flows; so that a constant clean surface of melted zinc is kept submitted to the action of currents of atmospheric air, the heavier portions of the oxide thus produced bring raked out of the retorts, and falling into a chamber underneath, thence to be removed either in a box on wheels into which they fall, or by means of shovelling; the lighter portions passing up a shaft, and being thence driven by a current of steam to the condensing chambers, in which the vapour passes through a series of frames on which the oxide is deposited, the air passing off through suitable chimneys. By tilting these frames, the oxide falls to the bottom of the chambers, and may be removed by any of the means ordinarily in use. These chambers are kept cool by means of water playing on their exteriors.

3. Bleaching the light oxide by means of water acidulated with sulphuric or acetic acid.

4. Grinding and compressing of the oxide of zinc, by means of a suitable mill. This mill consists of a conical roller revolving in a circular trough. This roller is placed on its side, with its narrowest diameter at the circumference of the trough. Underneath the trough is a chamber, into which the oxide falls after being ground.

5. The manufacture of oxide of zinc into paints, by combining the same with certain specified materials, in order to facilitate its drying.

The patentee employs umber, which is first dissolved in muriatic acid over a fire, and then concentrated to the consistence of butter or honey. To this is added resin, and the substance thus formed the patentee calls resinate of umber. This resinate, when mixed with the oxide of zinc, forms a quickly-drying paint. Instead of the resinate of umber, umber in its native state may be used, but not so advantageously. Another preparation to be employed in combination with the oxide is composed of one part umber, treated as above, two parts chalk or carbonate of lime, and four parts resin from the yellow pine. In addition to these, the patentee proposes another mixutre, which he terms resinate of lead white; oxide of lead dissolved in acetic acid being substituted for umber, and prepared in a similar manner.

CHARLES MAY, of Ipswich, engineer, and ROBERT LEGGETT, of the same place, foreman of mechanics to Messrs. Ransomes and May, of the same place. *For improvements in machinery for threshing and grinding corn, for cutting straw, and other similar substances; also improvements in applying steam power to give motion to such classes of machinery; and also improvements in machines for depositing seed.* Patent dated April 30, 1850.

Claims.—1. The combination of steam engines with portable threshing machines, so as to allow of the boiler and its fire being separated and at a distance therefrom (the steam is in this case supplied to the cylinder by steam pipes suitably covered with felt); also causing the bars of the "concave" of threshing machines to be fixed to flexible bands or bars, so as to be adjustable by screws and nuts, or by any equivalent means. Also, fixing the pinions of threshing-drum shafts by elastic collars, so that in the event of a sudden shock, no injury would result. And also giving motion to the drum at both ends.

2. The employment of three rollers in grinding machines; two of these rollers being of fine cut, and suitable for grinding oats and small grain, the other of coarser cut, and adapted for beans, &c., the wheel gearing of these rollers being so disposed as to work them simultaneously and in couples.

3. The arrangement of machinery for cutting straw and other similar substances, consisting of a series of rotating cutters and rotating claws by which the straw is laid hold of and submitted to the cutters.

4. The application of steam power to driving machines in farm buildings. In this arrangement shafting is dispensed with, the smaller engines being worked by steam generated in a boiler placed at any distance, and conducted to them by suitably-covered pipes; or one large engine may be employed to create a vacuum, and thereby actuate the smaller ones.

5. Various improvements in seed depositing machines, whereby the seed is alternately measured, and delivered first on one side of the axis and then on the other, by the reciprocating motion of the measuring instrument employed, and whereby the seed is alternately retained and set free by a tongue lever closing and opening the jaws of the said instrument. Also giving motion to the depositing portion of such machines, by means of cams. Also an arrangement of mechanism for retaining the depositing apparatus in their relative position, and yet allowing freedom of action to each. And also a method of alternately measuring and discharging the seed by the reciprocating motion of the instrument above referred to.

GEORGE MICHIELS, of London, gentleman. *For improvements in treating coal, and in the manufacture of gas, and also in apparatus for burning gas.* (A communication.) Patent dated April 30, 1850.

This patentee specifies and claims various improvements in treating coal previously to its being converted into coke, and also for use as fuel, and in recovering the various products resulting from these processes. For example; in mixing anthracite coal with bituminous, both are first reduced to powder, and cleansed by washing them with water, or by applying a jet of air to separate the light from the heavy and impure portions. For this purpose two hoppers are placed side by side, and the coals mixed in the proportion of 15 per cent. of bituminous coal to every hundred parts of anthracite, by means of valves revolving at different speeds in the bottom of each hopper, the bituminous coal-dust being intimately mixed with the other by a stream of air forced against it during its fall. The coke produced from this mixture is stated to be of superior quality, and the products which are obtained by the condenser attached to the oven are recovered by means of sulphuret of lead (galena) reduced by roasting to a state of sulphate and oxide, and then washed in the ammoniacal liquors, which yield sulphate of ammonia in the proportion of about 16 lbs. to the ton of coal. When powdered bituminous coal is used alone, coke of superior quality is likewise produced, and the resulting products, ammoniacal water and hydrocarburets recovered, in the case of the ammoniacal water, by a process similar to that above described; and the hydrocarburets, by heating, and then bringing them in contact with steam, by which they are

purified, and yield part of their carbon to the steam, which deposits it in the form of a very dense oil. Coals of tertiary formation—such as Bovey, Kimmeridge, and Brora coals, which contain 25 per cent. of water,—the patentee treats by heating in hermetically closed vessels, and then applying a jet of steam, which dries the coal and carries off the hydrocarburets to be purified, as above described.

Under that branch of the specification relating to the "manufacture of gas," the patentee claims the purification of gas by means of sulphate and oxide of lead, which, when exhausted as purifiers, are to be washed with ammoniacal water, when they can be reconverted by roasting to sulphurets, and made available for purifying purposes. And also improvements in the conversion of coal tar into gas of a very rich quality.

The third part of the specification relates to a new construction of burner to be used in combination with an improved regulator, by means of which the supply of gas can be equalised, and also a new construction of gas stove, fitted with a transparent plate, so that the attendant may be able by observing the colour of the flame, to ascertain exactly the proper time for increasing or diminishing the supply from the regulator, which is the same as used in combination with the burner, and which can be employed either in conjunction with or independent of a gas-meter.

"*Every man his own Fireman.*"—About eight o'clock on Tuesday evening a fire was discovered burning in the attic of a dwelling-house occupied by Mr. Peplow, tobacconist in Cheapside, Birmingham, caused, it was conjectured, by the spark from the candle. The fire was extinguished by the firemen of the District Company (without the necessity of the regular engines from the various offices being brought into play), by means of a *Portable Engine*, recently invented by Mr. Baddeley, of London, and which promises to be a very efficient auxiliary to a fire-brigade. On the first alarm of fire being given, and while the horses are being harnessed to the larger engines, a fireman may run to the spot with the one in question under his arm, and as in the foregoing instance, extinguish the fire, before other aids arrive."—*Birmingham Journal.*

LIST OF SCOTCH PATENTS FROM 22ND OF SEPTEMBER TO THE 22ND OF OCTOBER, 1850.

William Benson Stones, of Golden-square, Middlesex, Manchester warehouseman, for improvements in treating peat and other carbonaceous matters, so as to obtain products therefrom. September 23; six months.

Thomas Coats, of Ferguslie, of Paisley, and of Renfrew, North Britain, thread manufacturer, for certain improvements in turning, cutting, and shaping wood, and other materials. September 23; four months.

Evan Leigh, of Miles-platting, near Manchester, for certain improvements in machinery or apparatus for preparing and spinning cotton, and other fibrous substances. September 25; six months.

Jasper Wheeler Rogers, of Dublin, civil engineer, for certain improvements in the preparation of peat, and in the manufacture of the same into fuel and charcoal. September 30; six months.

Jesse Bridgman, of London, gent., for certain improvements in separating the fatty and oily from the membranous portions of animal and vegetable substances. September 30; six months.

Richard Prosser, of Birmingham, Warwick, civil engineer, for improvements in machinery and apparatus for manufacturing metal tubes, which improvements in machinery are in part applicable for other purposes, where it is required; also for improvements in the mode of applying metal tubes in steam boilers or other vessels, and in the mode of clearing out the tubes of steam boilers, and in the mode of feeding or supplying steam boilers with water. October 1; six months.

William Keates, of Liverpool, Lancaster, merchant, for improvements in machinery for manufacturing rollers and cylinders for calico printing and other purposes. October 4; six months.

James Young, of Manchester, Lancaster, manufacturing chemist, for certain improvements in the treatment of certain bituminous mineral substances, and in obtaining products therefrom. October 7; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in dyeing yarn, and in manufacturing certain woven fabrics. (Being a communication.) October 8; six months.

William Tudor Mabley, of Manchester, Lancaster, patent agent, for certain improvements in the manufacture of soap. (Being a communication.) October 10; six months.

Cuthbert Dimsdale, of Newcastle-upon-Tyne, dentist, for improvements in the manufacture of artificial palates and gums, and in the mode of setting or fixing natural and artificial teeth. October 11; six months.

John Beattie, of Liverpool, Lancaster, engineer, for certain improvements in steering vessels. October 14; six months.

John Grant, of Hyde Park-street, Middlesex, for improvements in heating and regulating temperature. October 14; six months.

Etienne Joseph Hanon Valcke, of Belgium, miller, for improvements in grinding. October 14; six months.

John Mercer, of Oakenshaw, within Clayton-le-Moors, Lancaster, gent., for improvements in the preparation of cotton, and other fabrics and fibrous materials. October 14; six months.

William Erskine Cochrane, of Cambridge-terrace, Regent's-park, Middlesex, and Henry Francis, of Princes-street, Rotherhithe, for improvements in propelling, steering, and ballasting vessels, in the pistons of steam engines in fire-bars of furnaces, and in sleepers of railways. October 14; four months.

Alexander Dixon, of Abercorn Foundry, Paisley, for improvements in moulding iron, and other metals. October 16; six months.

William Palmer, of Sutton-street, Clerkenwell, manufacturer, for improvement in the manufacture of candles and wicks. October 16; six months.

Eugene Ablon, of Panton-street, Haymarket, Middlesex, for improvements in increasing the draft in chimneys of locomotive and other engines. October 16; six months.

William Henry Green, of Basinghall-street, London, gent., for improvements in the preparation of peat, and in the mode of converting and applying some of the products derived therefrom to the preservation of substances which are subject to decay. October 12; six months.

Charles Bury, of Salford, Lancaster, manager, for certain improvements in machinery or apparatus for cleaning, spinning, doubling, and throwing raw silk. October 18; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in manu-

facturing yarn. (Being a communication.) October 18; six months.

John Percy, of Birmingham, Warwick, M.D., and Henry Wigging, of Birmingham, for a certain new metallic alloy, or new metallic alloys. October 21; six months.

LIST OF IRISH PATENTS FROM 21ST SEPTEMBER TO THE 19TH OF OCTOBER, 1850.

Peter William Barlow, of Blackheath, Kent, civil engineer, and William Henry Barlow, of Derby, civil engineer, for improvements in the permanent ways of railways. October 5; six months.

Amadée Francois Remond, of Birmingham, for improvements in machinery for folding envelopes, and in the manufacture of envelopes. October 5; six months.

William Benson Stones, of Golden-square, Middlesex, Manchester warehouseman, for improvements in treating peat and other carbonaceous and ligneous matters, so as to obtain products therefrom. (Being a communication.) October 7; six months.

William Cox, of Manchester, Lancaster, cigar merchant, for certain improvements in machinery or apparatus for manufacturing aerated waters or other such liquids. October 16; six months.

Edward Highton, of Clarence Villa, Regent's-park, Middlesex, engineer, for improvements in electric telegraphs, and in making telegraphic communications. October 17; six months.

(No English Patents Sealed this Week.)

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Oct. 24	2493	F. B. Geither	Birmingham	Expanding dining-table
,,	2494	William Poupard	Wych-street, Strand	Curvilinear beam for weighing-machines.
25	2495	E. O. Tindall and L. Tindall	Scarborough, York	Tindall's smoke elevator
,,	2496	Key, Mitchell, and Friez	Newgate-street	Convertable bedstead.
,,	2497	Edward Greaves	Sheffield, brass founder	Variable pendulum, or portable metronome.
26	2498	Bryan, Donkin and Co.	Grange-road, Bermondsey	Rotary rag-boiler for paper-makers.
,,	2499	Walter F. Robinson, Lt., R.N.	Junior United Service Club	Self-acting safety plug, or stopper for boats and other vessels.
,,	2500	Robert Watts	Manchester	Metallic packing for pistons.
28	2501	Joseph Harvey	Westminster Bridge-road	The Richmond car.
29	2502	Charles Maschwitz, Jun.	Birmingham	Box or case for postage stamps.
,,	2503	Dushoit and J. Roaf	Finsbury Pavement	The bush tent.
,,	2504	Thomas Parker	Kensington	Knife and fork cleaner.
30	2505	Charles Rowley	Newhall-street, Birmingham	The Prince's vest button.
,,	2506	John Smith and Henry Wills Ditchett, of the Firm of Smith and Co.	St. Augustine's-parade, Bristol	Blind roller.

CONTENTS OF THIS NUMBER.

Mechanics' Magazine,

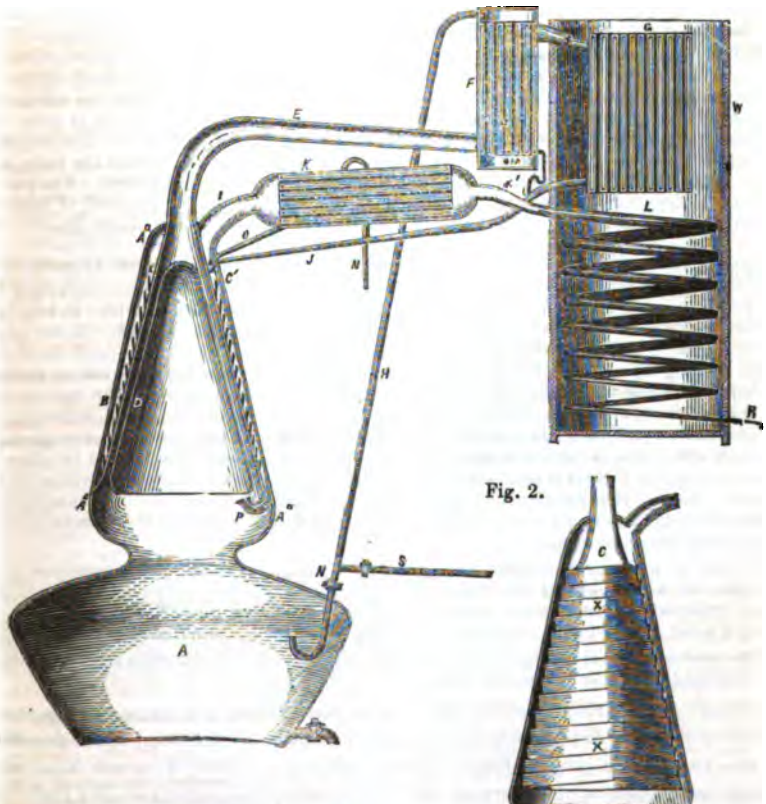
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1422.] SATURDAY, NOVEMBER 9, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MILLER'S PATENT IMPROVEMENTS IN DISTILLING AND RECTIFYING.

Fig. 1.



MILLER'S PATENT IMPROVEMENTS IN DISTILLING AND RECTIFYING.

[Patent for Scotland dated May 3, 1850. Specification Enrolled Nov. 1, 1850. Patentee, Maxwell Miller, of Glasgow, Coppersmith.]

Fig. 1 represents a sectional elevation of a distilling and rectifying apparatus embodying these improvements. A is a still of the common construction. A'A'A' a still head, a view of which detached from the rest of the apparatus is given separately in fig. 2; this still head consists of three cones B, C, D, placed concentrically one within the other, but at small distances apart. B and D are plain on both their surfaces, but round the exterior surface of C there winds from top to bottom an open spiral channel X. E is a pipe which forms a combination of the annular space between C and D, and leads to a wash-heater F, which consists of a vessel filled with a number of small metallic pipes *a a*, and to a low wine condenser G, which is mounted on a support in the upper part of a tub of water W. At M a wash charger is connected to F (but not shown in the figures), which keeps it constantly supplied with wash. I is a pipe which leads from the top of the outside cone B to a spirit condenser K, which consists of a number of small tubes laid longitudinally in a water cistern, but with a slight inclination upwards. K' is a pipe which leads from the upper end of the spirit condenser K, and terminates in a spirit worm L, which occupies the under portion of the water-tub W. The mode of working with the apparatus is as follows: A quantity of wash is run into the still A (supposed to be placed upon a common fire) from the wash-heater F, through the pipe H, say to the height of three or four inches. The vapour arising from this wash, as it becomes heated to boiling, ascends through the space in the still-head between the cones C and D, and through the pipe E into the wash-heater F, where part of it is condensed, and whence the remainder passes off into the low wine condenser G. The heat with which the vapour parts in passing through F, serves to warm the interior of that vessel, so that after a short time the wash (of which there is a constant supply from the charger with which it is connected at M) passing up through the pipes *a a*, flows over into the pipe H, and thence into the still in a nearly boiling state. The liquor of condensation which collects at the bottom of the vessels F and G, is conveyed back by the pipes *i* and *j* to the top of the space in the still-head between B and C, and poured into the spiral channel X. The liquor in its circuitous descent round the cone C is partly evaporated by the heat of the vapour, which is simultaneously ascending between C and D, and the portion of it so evaporated passes off through the pipe I into the spirit condenser K. So much of it as is not evaporated is ejected back into the still through a pipe P, attached to the lower end of the spiral channel X, in order to its being again distilled. In the spirit condenser K, a further process of concentration takes place; all the finer portions of the spirit passing off through the pipe K' into the worm L, where they are condensed and cooled, and thence they escape through the pipe R into a receiver; while the coarser and more aqueous portions are condensed and return by the pipe O into the spiral channel X, to be once more evaporated and condensed as before. Whatever may have been the quantity of wash with which the still was charged in the first instance, care must always be taken to allow no more to go in, till that quantity has been as completely as may be exhausted of its alcohol, and for this purpose the supply-pipe H, is fitted with a cock at N, immediately above which there is a pipe S, by which any surplus wash may be led off to a receiver placed in any convenient situation.

As soon as such complete exhaustion has taken place, the waste wash is removed from the still, and a fresh charge introduced to be worked as before. When the water in the spirit condenser K, becomes too hot for use, it is drawn off by a pipe N', and a fresh supply of cold water obtained from the water tub W (by means of a pipe not seen in the drawing).

Two modifications of this apparatus are described, in which tubular stills heated by steam are employed instead of a common still.

Claims.—What I claim as of my invention is the distilling and rectifying of spirituou liquids by means of the apparatus or apparatuses, methods and processes, before described as also by means of the modifications before particularised, that is to say, in so far a regards the employment of evaporating cones having open spiral channels winding round the exterior of the same, in combination with arrangements by which the liquor of condensation is returned back into the said spiral channels, as often as need be, as before exemplified and described.

MATHEMATICAL PERIODICALS.

(Concluded from page 196.)

XXIII. *The Scientific Receptacle.*

Origin. The first number of this periodical was issued on the first of April, 1791, under the title of "The Scientific Receptacle," containing Problems, Solutions, Paradoxes, Queries, &c.; selected from an extensive correspondence." The preface commences by stating that "the Mathematics need no recommendation, they carry their own reward, by leading us to truth by the nearest way, and with the greatest certainty," but "in order to the making any considerable progress — there seem to be requisite these four things.

I. A good natural genius as the basis and foundation.

II. A sufficiency of vacant time.

III. Industry and application.

IV. External assistance, either immediately from persons themselves, or by heir writings.

The Editor promises that "the work shall be as *original* as possible," and "does not presume to bring this publication into the world in opposition to the *Diaries*, or any other publication, but with a view to furnish ingenious gentlemen with amusement, after they have sent their productions to the other periodical publications, as many of them complain that a whole year is too long to wait." Even so early as 1791, the *non-remunerative* character of mathematical periodicals appears to have forced itself upon the attention of such as were desirous of benefiting the public by the diffusion of science, for the Editor proposes to *reprint* the "*Mental Accountant*" in the first two numbers of the *Receptacle*, in order to increase their sale, it being "well known that attempts of this kind have often been made, and after publishing one or more numbers the editors have found themselves in disburse, besides the trouble of composing the book, on which account they have given up the attempt." The *Scientific Receptacle* however was not destined to experience the common lot of its fraternity without a protracted struggle; in No. 8, the Editor notes, that "he sells enough of them *now* to defray the expenses of printing, &c.," and hence it continued to make its appearance at intervals until the completion of the *third* volume in 1819.

Editor. Mr. Thomas Whiting, Teacher of Mathematics, Master of Keppel House Seminary: Author of "Select Exercises;" "Key to ditto;" "Mathematical, Geometrical, and Philosophical Delights;" "Treatise on Astronomy," &c.

Contents. The usual contents of each number are Enigmas Charades, Rebuses, &c, with Answers; Philosophical, Critical, Philological and other Queries, with replies; Mathematical Questions with Solutions, and an occasional Essay on some important subject. The Enigmas &c., possess the average merit of such productions, nor would it be difficult to point out a *few* which are really entitled to the appellation of *poetical* compositions. Amongst the Queries are found many interesting discussions on a variety of subjects connected with Natural Philosophy, Chemistry, Astronomy, Antiquities, &c., &c. The late Dr. Gregory; Sir David Brewster; Rev. J. Grove; Messrs. Whiting, Bickford, Crosby, Swale, Newton Bosworth, Glendinning, Clarke, Thompson, Marrat, Baines, Jerwood, Massay, Sheridan, and many others, were extensive contributors to this department; and as the Editor exercised considerable care not to admit much that was either trifling or devoid of interest, this portion of the work contains a greater proportion of valuable matter than is usually found in works of a similar character. Several of the earlier contributions are intimately connected with corresponding inquiries in the *M. and P. Delights*, and hence the two works, which for a time were published simultaneously, ought to be examined together: this connection more especially refers to several communications from Drs. Gregory and Sangrado (*Who was this?*), and to the Editor's "New Theory on the Observations of the fixed Stars." Among the more prominent articles in this department may be noticed: — A Dissertation on the Aurora Borealis et Australis," by Mr. Charles Clarke; on the Observation of the Stars, by Mr. Whiting; on Agricultural Chemistry, by Mr. Clarke; on Musical Sounds, by Dr. Gregory; on

the Notion that the Four Planets, *Ceres, Juno, Pallas and Vesta*, are fragments of a larger Planet, by "David Brewster, L.L.D.," &c., &c. The Astronomical Game of Draughts, and a brief Account of tho Solar System, by the Editor; "On the cause of the Change of Seasons on our Earth," by Benjamin Workman, Esq., M.A.; On the Calculations of High Water at London Bridge, by Mr. Thomas Martin.

In every periodical, and especially a Mathematical one, the "*Notices to Correspondents*" are fraught with peculiar interest both to the general reader and the parties concerned. Many a youthful aspirant has been swept off the ascent to the Temple of Fame by the untoward breath of a single line, whilst on the other hand an encouraging word of Editorial approval has long been fondly remembered as the *first* trophy of an honourable career. Very frequently too, the peculiar character of a correspondent peeps out from the nature of the reply to his communication; the curious, the dissatisfied, the monopolizing, the carping, and the apparently neglected — pours each his tale of woe into the Editor's ear; and though the majority of such complaints are more honoured by the "breach than in the observance," whenever a reply *is* vouchsafed, be it the harbinger of "weal or woe," some glimpse of *human nature* is almost sure to render itself visible amidst the cloud of words which envelope the Editor's oracular response. Several of the correspondents to the *Receptacle* would seem to have had something of *the unaccountable* in their composition; and as the Editor appears to have shaped his remarks according to the pattern before him, a selection from these *trite* sayings may not be unworthy of notice, especially as they now and then convey a significant hint of the manner in which affairs were managed in the "good old times of yore."

I. *Old Questions.* Mr. Whiting had announced, in the preface to the first number, that he would endeavour to make the work "as *original* as possible;" hence in No. 2, he proposes that "no *gentleman* in future will take the trouble to send *old* questions;" and after reminding *two* gentlemen that their questions were copied *verbatim* from the *Lady's Diary* and the *London Magazine Improved*, he requests information of such practices, "that *plagiarism* may meet its just censure." In No. 4, he returns to the subject, notices *four* attempts of the same kind, and charges Mr. Eling with sending "a question from *Turner's Exercises*, and assuring us *upon his honour* it is a *new* one; this (being) the third time he has attempted to impose *old* questions upon us!" A correspondent is informed in No. 7, that "the question about the conical tub is inadmissible for *two* reasons; first, because it is in Dr. Hutton's *Mensuration*; secondly, because it is in the *Lady's Diary* for the present year;" in a subsequent number two "gentlemen are *respectfully* informed that their solutions are *not* right;" whilst at the conclusion of the work an "*angry fellow*" who "gives his instructions in a very peremptory manner to have his answers to two questions printed," and refers to "Dr. Hutton's *Course* for finding the centre of gravity of the hoof of a cone," is gravely told that in the place cited the Editor can only find "a rule for finding the centre of gravity of a *brick-wall!*" and that it is "fortunate the book was at hand, otherwise the error might have passed to the *discredit* of the person and the Editor." Lastly; "the *Prize* of eight *Receptacles*" is awarded "to *Poeticus* for *pirating* a question from *Martin's Magazine!!*"

II. *Postage.* This was a *serious* matter in those days, and the *officials* at the various offices were as much alive to business and as fond of fleecing a luckless offender *then* as *now*. In No. 3 a correspondent's letter "weighed an ounce, on which account it was charged *two shillings;* the same gentleman's *single* letter was charged *double* the time before, on account of its being *rolled up so thick*." Subsequently we find "a young gentleman" writing "*postage unpaid*," and also that "Mr. Nicholson's letter came *unpaid*, although he wrote *post-paid* upon it; I (the Editor) suppose the person he sent it by kept the money." This would seem to have been no uncommon case, for No. 10 contains a caution to correspondents to "take care *who they send their letters by* to the office, as *two* came unpaid this time, with "postage paid" wrote on them; another paid fourpence, but being *double*, was charged eightpence; and one came to hand *over weight*, charged *two shillings*,

but was not taken in." Such excessive charges for postage must not only have tended materially to repress correspondence, but have formed a serious obstacle to the continuance of such periodicals.

III. *Disappointed Correspondents*, &c.—These, of course, are neither "few nor far between." No. 2 announces the receipt of several letters which "came *too late* to be made use of this time," amongst which is a bulky one from "Mr. Thomas Nield, master of a boarding-school at Hawarden, Flintshire," and an extensive contributor to scientific periodicals. Succeeding numbers contain similar records of disappointed hopes and blighted ambition. The Editor is, indeed, "sorry they wrote too late," but this is only a poor compensation for the numerous holocausts annually offered on the altar of necessity. At last a fire breaks out at "Astley's," and a host of contributors are informed, in the *middle* of the last page of No 8, "that a parcel containing their letters was *lost* the night the fire happened, on which account many ingenious pieces are lost;" whilst at the *bottom* of the *same* page the letters are said to be "found, and shall be made use of *next* time." Upon this announcement making its appearance, "a *person* of York" asks the Editor if he supposes the correspondents to the *Receptacle* "so ignorant as not to know that a *whole* page is printed at once?" The reply is promptly, "No, I do not, though I think them *less* ignorant than the querist; or he would have known that not *one* page, but *twelve* are printed at once." He then explains that the *last* line of the page was added after the rest of the page had been set up, "thinking it needless to take the remarks asunder again." In addition to the usual duties of tuition, &c., Mr. Whiting appears to have officiated as caterer on some occasions for curious contributors; but his labours were not always appreciated. A "young gentleman," it seems, had written to him, "*postage unpaid*," for a "*Gentleman's* and a *Lady's Diary*, with *supplement*," which were accordingly "made up into a parcel, paid for booking, and sent by the coach, as per advice," the aforesaid young gentleman engaging to call upon Mr. Whiting and pay for them before the next number was published. This not being done, he is here threatened with the "publication of his name," which in No. 8 turns out to be "J. T. Hughes, who is gone to college to be cured of his meanness, if curable, which we much doubt." Mr. Hughes added ingratitude to neglect, for he took "much pains to calumniate the *Receptacle* before he left the north." In No. 11, "an ingenious correspondent observes, that Mr. Hampshire has a right to be offended at *two* things; viz., first, for not placing his solution of Ques. 110, page 146, *Delights*, in a better place, that is, last; secondly, for not having said, answered by Mr. Hampshire *only*." "The Editor," however, "does not see why page 146 should not possess *equal* merit with page 156;"—"a star of the *first* magnitude will shine equally conspicuous, whether in the head or tail of a constellation;" and "has a better opinion of Mr. Hampshire's judgment than to suppose he could be offended at any such trifles!" This last sally was thoroughly decisive, and henceforth the "Master of Keppel House Seminary" was permitted to pursue the "even tenor of his way" without further molestation.

Questions.—The first series of mathematical questions in this periodical extend from 1 to 368 inclusive; besides these, there are 64 not numbered consecutively, so that the total number of questions is 432, most of which received solutions. In No. 19 it was proposed to publish "No. 12 of the *Delights*," and No. 20 contains a collection of 20 questions to be answered in No. 13 of that work: this does not seem to have met with the approbation of the correspondents, and as "very few solutions were sent," the project was abandoned. The first set of 20 questions were mostly selected from "*Davison's Repository*," a periodical projected by "John Davison, Teacher of Mathematics," author of "A Comprehensive System of Algebra," "A New System of Arithmetic," &c.; but in consequence of this gentleman's decease, only *one* number was published, and "they had not received any solutions." The subjects to which the questions relate, embrace the whole circle of mathematical science as taught at the period. The well-known names of Lowry, Gregory, Swale, Campbell, Leybourn, Hampshire, Sanderson, &c., are of frequent and extensive occurrence in the first two volumes, and hence it may readily be inferred that the geometrical exercises

are both numerous and valuable. Many of Mr. Lowry's earlier *spherical* researches are published in the *Receptacle*, and the honours of solution are frequently divided between the proposer and Mr. William Armstrong, another of Mr. Howard's able pupils. Dr. Gregory's contributions to the mathematical department commence with No. 2 (August, 1791), and are probably among the earliest *printed* compositions of that afterwards distinguished author; being *three* years earlier than those instanced by the writer of his memoir in the *Penny Cyclopædia Supplement*. He soon after appears as "Master of a Boarding-School," and "Land Surveyor, Yaxley." Colin Campbell, Esq., author of "*Mathematical Lucubrations*," commenced his career at the same time, being then "a pupil in Mr. Howard's school, Carlisle." The name of the late venerable Dr. Dalton also occurs in several of the first numbers, and No. 8 (August, 1794) contains several articles from the pen of "J. H. Swale, of Becca Lodge, near Aberford, Yorkshire."

Ques. 31 demonstrates the formula tan. A + tan. B + tan. C = tan. A tan. B tan. C; it was proposed by "Mr. Garrard, at the Union Observatory, Denmark Hill," and answered in the rude notation of the time by Messrs. Hulland, Hewitt, Park, and Keith.

Ques. 55 is proposed by Mr. Keith, and requires a demonstration of the following theorem:—"If two perpendiculars be demitted from any point within an equilateral triangle upon the opposite sides, the sum of the squares of those perpendiculars, together with their rectangle, is equal to three-fourths of the square of the distance of that point from the included angle of the triangle." It was solved by Messrs. Garnett, Bell, and Ryley; the Editor also remarks that "the point may be given anywhere *within* the circumscribing circle."

Ques. 62, by Mr. Thomas Glanville, requires a satisfactory proof that "an infinitely small quantity, taken an infinite number of times, is equal to a *finite* quantity." Mr. Ryley's proof is based upon the equation $\frac{m}{n}=p$, when n is supposed to become infinitely small, and Mr. Lowry observes, "it is upon this principle that the whole science of geometry belongs; for a line is made up of an infinite number of points, infinitely small; a plane is made up of an infinite number of lines infinitely narrow; and a solid is made up of an infinite number of planes, infinitely thin:—consequently an infinitely small quantity taken an infinite number of times is equal to a finite quantity."

Ques. 108 is proposed by "L.L.D., F.R.S.," and requires a *geometrical* demonstration that "if O be divided by O the quotient may be either O or any other given quantity;" a solution by Mr. John Griffith is here transcribed. "With radius = half the given quotient describe a semicircle ACB, in which inscribe the triangle ACB, then by the circle it will be AD : CD :: CD : BD, where CD is a perpendicular demitted from the right angle C. That is $CD^2 \div AD = BD$; but when $AD = 0$; CD will become so too, and $BD = AB = (0 \times 0) \div 0$; which was to be proved."

Ques. 139 is another by "L.L.D., F.R.S.," requiring a simpler demonstration that "the fluxion of x^2 is $2x\dot{x}$:" it was answered by Mr. G. Saunderson, and a similar inquiry forms Ques. 35 of the *Western Miscellany*.

Ques. 154 by Mr. John Fletcher, of Liverpool, inquires "through what curve a circle must roll, that a point in its circumference may describe a right line." A solution was furnished by Mr. John Ryley, of Beeston, afterwards editor of the *Leeds' Correspondent*. The same inquiry forms Ques. 63, *Leybourn's Repository*, N.S.; Problem 6, p. 4, *Gaskin's Geometrical Problems*, and is extended to the locus of *any* point within the circle by Mr. T. Elliott in Ques. 144 of the *Educational Times*.

Ques. 164-5-6, are proposed by Mr. Olinthus Gregory as examples of the "Use of the Sliding Rule," an excellent treatise on which he prepared about this time. The work, however, was never published, and still remains in manuscript.

Ques. 169 relates to Equation of Payments, and was re-proposed from the *Lady's Diary* by Mr. Thomas Todd. This subject seems to have attracted considerable attention about this time, and various forms of the inquiry are discussed with more or less acrimony in almost all contemporary periodicals.

Ques. 183 is the one for *pirating*

which the prize of eight *Receptacles* was awarded by *Poeticus*. It is "Ques. 366 of *Martin's Correspondence*, and a solution by G. Cetii (Mr. Wales) may be seen at p. 831., vol. iv." Mr. O. G. Gregory appears to have been the Editor's informant on this occasion.

Ques. 203, 204, "were first proposed at the end of an ingenious little work, entitled the *Antecedental Calculus*, by *James Glenie, Esq.*, M.A., F.R.S." Constructions were furnished by Mr. Armstrong, but these not appearing satisfactory, several "corrections and remarks" are added by the proposer, Mr. Lowry, in the succeeding number. They relate to the construction of triangles when the *cubes* of the sides are concerned, and are connected with Ques. 983, 1007, *Lady's Diary*.

Ques. 256 is proposed by Mr. John Knowles, of Liverpool, the projector and Editor of the *first two numbers* of the *Student*, and states that, "if from any point P, in the diameter AB of a circle continued, any line be drawn to cut the circle in C and again in D, and DE be drawn perpendicular to AB, to cut the circle in E, and EC joined, then CE will always cut the diameter in the same point G." Two demonstrations are given by J. H. Swale, and the property itself is obviously a simple case of *Poles* and *Polars* in reference to the circle. The question was proposed by Mr. Knowles in the *British Diary* for 1796, but owing to the discontinuance of that work, it was here re-proposed: it afterwards appeared as No. 7 in the *first* number of the *Student*, and also forms Theorem xiii., pp. 59-60 of *Muller's Mathematics*, 1748.

Ques. 259 proves the following property of any pentangular figure; "join all its angular points, bisect the lines joining those points, and join the points of bisection; then, thrice the sum of the squares of the sides of the figures is equal to the sum of the squares of the diagonals, together with four times the sum of the squares of the lines joining the points of bisection." Both the proposition and its demonstration are given by Mr. Lowry.

Ques. 11, No. 23, by Mr. Joseph Hive proves that "the relation existing between any trapezium and its greatest inscribed rectangle" is as 2 : 1; the relation is elegantly deduced by Mr. Joseph Lewthwaite, now of Halifax.

Ques. 9, No. 24, furnishes a calculation to Ques. 378, No. 21, *Math. Companion*; a proposition which has been already alluded to in the *Mech. Mag.*, current volume, p. 194. It was here solved by J. A. Dotchen, of London, who shows the existence of *two* points equally answering the conditions, a circumstance, it is observed, which had not been noticed by Mr. Simpson in his *Geometry*.

Besides the preceding there are numerous valuable exercises in Spherical Geometry, Geometrical Analysis, Construction, &c., but of which no adequate description can be given in any reasonable space unless something were attempted after the manner of *Lawson's Synopsis*; seeing they mostly consist of the construction of triangles from given data. The questions relating to Algebra, Mechanics, Astronomy, Trigonometry, &c., are also well worthy of notice, and contain many practical examples of considerable value to the student.

Contributors. — Messrs. Armstrong, Atkin, Baines, Barlow, Barrow, Bickford, Birkbeck, Birch, Bosworth, Brewster, Bronwin, Burdon, Campbell, Clarke, Clifton, Crosby, Dalton, Dawes, Davis, Davison, Dotchen, Edwards, Elliott, England, Farey, Fildes, Fletcher, Garnett, Gilbert, Glendenning, Gregory, Griffiths, Hampshire, Harvey, Hearding, Hewitt, Hine, Hughes, Humber, Jerwood, Keith, Kemp, Lamb, Lewthwaite, Leybourn, Lowry, Maffett, Marrat, Massey, Martin, Milner, Montjoy, Nesbit, Nicholson, Nield, O'Riordan, Robarts, Rodham, Ryley, Saunderson, Swale, Taylor, Thompson, Todd, Tivers, Veysey, Weston, Wolfenden, Woolcot, Whiting, Winward, Wright, Wilkinson (Richard), &c., &c.

Publication. — The publication was originally intended to be half-yearly, viz., in April and August of each year; but owing to various circumstances, the work was issued very irregularly, so much so, indeed, that the 26 numbers extended over a period of not fewer than 28 years. The greatest portion of the three volumes were "printed by W. Kemmish, for the Editor, and sold by T. N. Longman, Paternoster-row, London.

THOMAS WILKINSON.

Burnley, Lancashire, October 30, 1846.

MEMOIR OF THE LATE WILLIAM MURDOCK, OF SOHO. BY MR. WILLIAM BUCKLE.

(Read before the Institution of Mechanical Engineers, Birmingham, September 23, 1850.)

The late William Murdock was born at Bellow Mill, near Old Cumnock, Ayrshire, in 1754, where his father, an ingenious man, carried on the business of millwright and miller, and also occupied a farm on the estate of the Boswell family of Auchinleck, by whom he was much esteemed for his integrity and ingenuity. Little is known of Mr. Murdock's habits and pursuits prior to his joining the establishment of Messrs. Boulton and Watt, at Soho, in the year 1777, then in its infancy—but he must, before he left his native country, have had celebrity, as he was employed to build a bridge over the River Nith, in Dumfries-shire, a very handsome structure, which still exists. His talents were soon justly appreciated at Soho, particularly by the celebrated James Watt, with whom he continued on terms of the warmest friendship to the time of Mr. Watt's death, in 1819. After a short residence of about two years at Soho, Messrs. Boulton and Watt appointed him to superintend the erection and undertake the general charge of their engines in Cornwall, where he erected the first engine with the separate condenser in that district. In the year 1785, he married the daughter of Captain Paynter, of Redruth, Cornwall, and had four children, of whom only one son survives; his wife died in 1790 at the early age of twenty-four years. In 1798. Mr. Murdock returned to Soho, to take up his permanent residence, and superintend the erection of the machinery at Soho Foundry, and occasionally the erection of engines at a distance. His energies to further the interests and celebrity of that establishment were not used in vain, for they assisted in no slight degree in procuring it a name celebrated throughout the civilised world. Mr. Watt, in his "Notes on Dr. Robinson's Treatise on the Steam-engine," bears testimony to some valuable improvements by Mr. Murdock, and others are recorded in a patent he took out in 1799, which included:—

1. Boring cylinders, by means of an endless screw working into a toothed wheel, instead of spur gear, for the purpose of producing a more smooth and steady motion.

2. Steam cases for cylinders cast in one piece, fitted to the cylinder with a conical joint at top and bottom, instead of being made in separate segments bolted together with caulked joints, according to the previous practice.

3. The double D slide valve in place of the four poppet valves in Mr. Watt's double engine, for the purpose of simplifying the construction and working, and saving the loss of steam in the two steam chests at each stroke; also the cylindrical valve, for the same purpose, with a revolving motion, either continuous, or reciprocating through part of a circle.

4. A rotary engine was also included in this patent. Mr. Murdock had one of these engines, of about a half-horse power, set to work about 1802, at the Soho Foundry, to drive the machines in his private workshop, and it continued there for about thirty years, and often in nearly constant work, and was found to work well.

Now that locomotive steam engines applied to carriages have become so extensively used, it is proper to record that the first so applied was made by Mr. Murdock, upon the principle described in the 4th article of Mr. Watt's specification of 1769 (since adopted in all engines for that purpose); and this was seen in 1784, by persons still living, driving a model wagon round a room in his house at Redruth, where he then resided. This original engine was frequently exhibited by him to friends at his house at Handsworth up to the time of his death. It is still in working order, and is exhibited to the present meeting. It was constructed entirely by his own hands.

At the time that he was making experiments with his locomotive engine, he greatly alarmed the clergyman of the parish of Redruth. One night, after returning from his duties at the mine, he wished to put to the test the power of his engine; and as railroads were then unknown, he had recourse to the walk leading to the church, situated about a mile from the town. This was rather narrow, but kept rolled like a garden walk, and bounded on each side by very high edges. The night was dark, and he alone sallied out with his engine, lighted the fire or lamp under the boiler, and off started the locomotive with the inventor in full chase after it. Shortly after he heard distant and despair-like shouting: it was too dark to perceive objects, but he soon found that the cries for assistance proceeded from the worthy pastor, who going into the town on business, was met in this lonely road by the fiery monster, whom he subsequently declared he took to be the Evil One in *propria personâ*. Whoever has been on one of our modern railroads on a dark night, and seen an approaching train—now no novelty—may easily imagine what effect the awful sight would have on the nerves of an elderly gentleman of the last century; and although the demon was of small dimensions,

yet it was a total stranger, and quite unlooked for in such a locality.

Mr. Murdock is still better known to the public, and most deservedly so, by his invention of applying the light of gas from coal to economical purposes. In the year 1792 he employed coal gas for the purpose of lighting his house and offices, at Redruth, in Cornwall; and this appears to have been the first idea of applying the light to useful purposes, although the gas had been discovered and obtained, both naturally and artificially, more than half a century before. Mr. Murdock at that time manufactured the gas in an iron retort, and conveyed it in pipes to the different rooms of his house, where it was burned at proper apertures or burners. Portions of the gas were also confined in portable vessels of tinned iron and other materials, from which it was burned when required, forming a moveable gaslight. After various experiments, by which he proved the economy and convenience of light so obtained compared with that from oils or animal substances, he perfected his apparatus, and made a public exhibition of it by lighting up the front of Mr. Boulton's manufactory at Soho, on the occasion of the general illumination for the Peace of Amiens, in 1801. He subsequently lighted up some cotton mills at Manchester, beginning with that of Messrs. Phillips and Lee; and he published a paper describing the advantages in the "Philosophical Transactions" for 1808, for which the Royal Society presented him with their large Rumford gold medal.

Mr. Murdock took out a patent in 1810 for boring pipes for water, and cutting columns out of solid blocks of stone. Instead of boring out the whole inside contents of the pipe, a solid cylindrical core of half an inch diameter less than the inside of the intended pipe is cut out of the centre of the block of stone by a cylindrical crown saw; or a column is formed by a similar process of cutting it out in its finished form from the centre of the block, leaving the rest of the stone in the form of a pipe, the cores of the larger pipes being available for columns, thus effecting a saving of labour and material. A machine was constructed at Soho Foundry on this plan, where it was set to work; and also at Mr. Rennie's works, in London. The first pipe bored was of marble, and proved quite successful. The patent was subsequently sold to a company in London, with the object of supplying water of greater purity by conducting it through stone pipes instead of iron. Mr. Murdock in 1802 applied the compressed air of the blast engine employed to blow the cupolas at the Soho Foundry for the purpose of driving the lathes in the pattern shop, by using it to work a small engine with a 12 inch cylinder which was connected to the lathes, the speed being regulated as required by varying the admission of the blast. This engine continued in effective use for about thirty-five years and was only discontinued on the occasion of an alteration of the shop.

He also constructed a lift, worked by compressed air, for the purpose of raising and lowering the castings from the boring mill to the level of the foundry and the canal bank, which continued in constant use for about thirty years.

Mr. Murdock also applied compressed air to ring the bells in his house. A small brass cylinder, 1 inch diameter, was fixed against the wall of his room, having a piston in it with an ivory knob at the top, and a three-eight inch tube was carried from the bottom of the cylinder to the bell, terminating in a similar cylinder and piston, with a clapper projecting from it, which struck the bell when the piston was driven outwards by the first piston being pushed down. He had a range of these in his study communicating with each room of his house, and these are still in existence, after having worked satisfactorily for thirty-five years. Sir Walter Scott having once heard them described, was so much pleased with the plan that he had his own house at Abbotsford fitted up in a similar manner. An accidental circumstance that Mr. Murdock observed of some iron-borings and sal-ammoniac getting mixed together in his tool chest, and rusting his saw blade nearly through, led to the invention of the cast-iron cement, that has since become so universal and important an assistant in the construction of machinery, and became a very extensive manufacture at the Soho works.

He made several experiments on the projectile power of high-pressure steam, and a specimen has been preserved of a lead ball, that he fired from a steam gun against the wall of the Soho Factory. This ball is now laid before the meeting; it is about an inch diameter, and it bears the date of the experiment, 1803, engraved upon it.

So completely was he absorbed at all times with the subject he had in hand, that he was regardless of everything else. When in London, explaining to the brewers the nature of his substitute for isinglass, he occupied very handsome apartments; he, however, little respected the splendour of his drawing-room, and fancying himself in his laboratory at Soho Foundry, proceeded with his experiments, quite careless and unconscious of the mischief he was doing. One morning, his landlady calling in to receive his orders, was horrified to see all her magnificent paper

hangings covered with wet fish skins hung up to dry, and he was caught in the fact of pinning up a cod's skin to undergo the same process. Whether the lady fainted or not is not on record, but the immediate ejectment of the gentleman and his fish was the consequence.

When engaged in any of his favourite pursuits, no man could be more regardless of his person and apparel than he. Once, when he was busily employed in experiments on gas-making, he was hastily called to London. After dressing for the journey he could not resist taking another last look at the progress of the gas apparatus, and in doing so he accidentally dipped the tails of his coat into a tar bucket that stood by. This was of little consequence to him, for at that time a sniff of coal tar was more grateful to his sense of smell than would have been all the odours of Arabia. The weather however, being warm, he soon found the scent waxed more potent than pleasant, and he readily thought that when shut up in a coach, the other passengers might be the owners of noses that would not properly appreciate the merits of his favourite preference. He got into the coach first, and was speedily followed by three gentlemen to whom he was unknown. The coach soon became a perfect gasometer; he, however, was the first to fall foul upon the proprietors of the vehicle for presuming to use pitch instead of or as a substitute for paint in ornamenting their carriage. At the end of the first stage the guard was sent for, and upon inquiry it was actually found that pitch had had been employed, which completely explained the cause of the nuisance. After passing a hot summer's night close shut up, the unfortunates were next morning set down in London, an abomination to themselves and to those who were unfortunate enough to come near them.

In the year 1815, Mr. Murdock erected an apparatus of his own invention for heating the water for the baths at Leamington, by a circulation of water through pipes from a small boiler, a process since adopted extensively for heating buildings. The first conservatory heated in this way was that of his son at Handsworth, the apparatus of which he erected about the same time, and it remains in use to the present day. The heated water is conducted over the building by a pipe leading from the top of a small boiler, and the pipe returns to the bottom of the boiler, delivering the cold water into the boiler.

During the erection of the apparatus at Leamington, he met with a severe accident, which for some time threatened to prove fatal; a ponderous cast-iron plate fell upon his leg just above the ankle, and nearly severed the lower part of the leg. In his latter years his faculties, both corporeal and mental, experienced a gradual decay, and he lived in absolute retirement. He died on the 15th November, 1839, aged 85 years; and his remains were accompanied by several old and attached friends, and by the workmen of Soho and Soho Foundry, to their last abode in Handsworth Church, and there deposited near those of Mr. Boulton and of Mr. Watt. A bust, by Chantrey, serves to perpetuate the remembrance of his manly and intelligent features.

The very interesting locomotive referred to in this paper was exhibited in action, and was examined with much curiosity. The gold Rumford medal, also exhibited, is a massive piece of precious metal, its intrinsic value being about fifty pounds. The rotary engine, the ball-projected by steam, and a bust by Chantrey, were likewise shown. These are in the possession of the son of Mr. Murdock. The reading of the paper, and the exhibition of these evidences of mechanical genius, excited great interest.

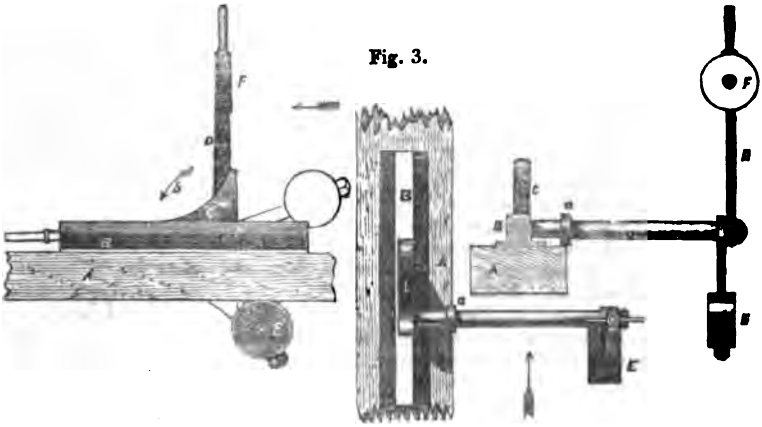
BECKERS' SELF-ACTING SIDING STOP.

(Registered under the Act for the Protection of Articles of Utility. Gustavus Edward Beckers, of the Railway-station, Paddington, C.E., Proprietor.)

A late disastrous case of collision at a railway station, which appeared to have arisen from some carriages that had been moved to a siding out of the way, having got back upon the main line—nobody could exactly tell how—has given rise to the present very clever contrivance of Mr. Beckers, of the Paddington terminus of the Great Western Line. By means of this stop, when once a train or carriage has been moved off a main line to a siding, it cannot get back, but must remain there, unless the stop is wilfully and maliciously interfered with. Fig. 1 is an end, fig. 2 a side view, and fig. 3 a plan of this stop. AA is a longitudinal railway sleeper. BB the rail, a portion of which is cut away in order to allow the stop to enter it, as shown in fig. 3. C is a stop which projects over the rail, and is free to move in one direction on being struck by the wheels of a truck or carriage entering a siding. The stop is mounted on one end of a shaft supported in a bearing *a*, which shaft carries at its outer end a lever D, and counter weight E. F is a signal-disc attached to the lever

Fig. 1. Fig. 2.

Fig. 3.



D. The action of the stop is as follows: — Supposing a carriage to be about entering a siding in the direction of the arrows, the wheels come in contact with the stop C, which, being free to move forward and downward in the direction of the arrow *b*, lies flush with the rail, and allows the carriage or train of carriages to pass on into the siding. With the forward motion of the stop the lever D is depressed, and the weight E consequently raised, as shown by the dotted lines, fig. 2. When the last carriage has passed, the weight falls down, raises the signal lever, and restores the stop to its original position.

When it is required to take a carriage or train out of the siding, the lever must be forcibly pressed down by hand.

The Directors of the Great Western Line have shown commendable promptitude in the adoption of this useful invention. It was registered only last week, and may already be seen in full operation at Paddington.

CHANGE IN PATENT LAW PRACTICE.

We have received the following notice from the office of the Attorney-General:—

The Attorney-General, with the assent and concurrence of the Solicitor-General, hereby gives notice that every person applying for a patent after the 2nd day of November instant, will be required to deposit in the office of the Attorney-General or Solicitor-General an outline description in writing or drawing, to be approved by the Attorney-General or the Solicitor-General before any report will be made on such patent.

JOHN ROMILLY.

November 2, 1850, Lincoln's-inn.

The change thus introduced (viewed by itself) is a very fair one, and will, we have no doubt, be universally approved of.* It is precisely what the Editor of this Journal recommended when examined before the late Commission on the Privy Seal and Signet Offices. "At present it is only in opposed cases that an entire specification is lodged. * * You would require a similar outline specification to be deposited in all cases, and not merely in opposed cases? Precisely so."—*Evid. of J. C. Robertson.*

Although, however, this will henceforth place all patentees on the same footing, and put an end to that fertile

* The disregard of their personal interests shown by Sir John Romilly and Sir Alexander Cockburn, in the issuing of this order, ought not to pass without its due meed of praise. One of the chief motives to opposition has hitherto been a desire to compel the deposit of such outline specifications; and now that the new order will secure a deposit in every case, there will not be half the number of oppositions entered, and a consequent diminution of more than one-half of the fees now derived from this source.

source of abuse—*open patents*, we are far from thinking that it will meet all the difficulties of the case. It is still an unsettled point what the value of such an outline specification is when lodged. The question has never yet been raised in the courts, and there is no decision upon it. Must a patentee adhere to it rigidly both in letter and spirit? Or may he alter, amend, or amplify? And, more especially, is he to be tied up from benefiting by any second thoughts (proverbially the best) which may occur to him during the six months still allowed him to enrol his final specification? If it be the intention to exclude him from the benefit of such second thoughts, how is this to be reconciled with the existing rule of law, that a patentee must disclose all he knows respecting his invention *at the date of enrolling his specification*, under pain of forfeiture of his right? The law-officers of the Crown can clearly have no right, of their own authority, so to set aside the law of the land. To put their present change of practice in harmony with the existing law, they must do something more. They may provide, in some way or other, protection for these second thoughts, or they may have it declared by legislative enactment that the patentee need only disclose in his specification all he knew at the date of his patent. If, however, patentees are still to be entitled to have their "second thoughts," we shall very surely meet with frequent cases of patentees including all they can borrow or steal under that category; and if, on the other hand, any inventor is to be at liberty to refer all his knowledge of an invention back to the date of his patent, that will be tantamount to a permission for him to tell just as much or as little as he pleases, which would be subversive of the whole purpose for which patents are granted. Either way we arrive at a result which is far from satisfactory; and we shall not be surprised if, in the end, the circumstances of the case should dictate the necessity of abolishing outline or provisional specifications altogether, and requiring of every patentee to enrol a complete specification *before* he obtains his patent. We should in that case be only doing like our neighbours—England being the only country where the provisional practice exists.

INVESTIGATION OF MR. BILLS'S RULE FOR SOLVING CUBIC EQUATIONS. BY MR. BILLS.

Sir,—It is only this morning that my attention has been directed to the request of your correspondent, "P. Q.," that I would give the investigation of my Rule for Solving Cubic Equations. I at once comply with his request, and send you the following investigation of it, which I hope you will insert in your next Number:—

Let

$$x^3+ax^2+bx+c=o$$

be the given cubic equation.

Put

$$a_1=\tfrac{1}{3}a, \text{ and } b_1=\tfrac{1}{3}b,$$

then the above will become

$$x^3+3a_1x^2+3b_1x+c=o.$$

In this last equation, substitute $y-a_1$ for x; and put

$$A=b_1-a_1^2,\ B=\tfrac{1}{2}(a_1b_1-c), \text{ and}$$
$$C=B+a_1A;$$

then we shall find the transformed equation to become

$$y^3+3Ay=2C.$$

Applying Cardan's rule to this latter equation, and putting

$$D=\sqrt{C^2+A^3},$$

we find

$$y=\sqrt[3]{C+D}+\sqrt[3]{C-D};$$

hence

$$x=y-a_1=\sqrt[3]{C+D}+\sqrt[3]{C-D}-a_1.$$

Finally, putting

$$E=\sqrt[3]{C+D}, \text{ and } F=\sqrt[3]{C-D},$$

we have $x=E+F-a_1$, as asserted in my Rule.

I am, Sir, yours, &c.,

SAMUEL BILLS.

Hawton, Nov. 2, 1850.

THE VERTICAL TUBULAR BOILERS OF THE AMERICAN STEAMERS "ATLANTIC" AND "PACIFIC"—THE INVENTION OF THE EARL OF DUNDONALD.

(From the *Franklin Journal* for September.)

The success attending the use of this form of boiler in the steamers *Atlantic* and *Pacific*, running from New York to Liverpool, and the *Osprey*, from this port to Charleston, has called the attention of engineers particularly to the subject; and although, for three years past, boilers of this kind have been gradually coming into use, still it was not until the success of the steamers above named that

entire confidence was placed in them for marine purposes. The origin of that which is called new is at all times a matter of interest, and having examined a few works on the subject, I offer some remarks, showing the progress made by the invention since 1825.

[The writer here describes, successively, Eve's apparatus, 1825; Steenstrup's, 1828; Nott's, 1830; Holloway's, 1835; Hall's, 1841; and then proceeds as follows:]

The Earl of Dundonald patented, Jan. 19, 1843, a boiler, a longitudinal section of which is here shown. (Fig. 13.)

The Earl says, "This figure shows a section of apparatus for generating steam for steam engines, constructed according to this part of my invention, and the apparatus is composed partly of tubes or hollow surfaces, the interior of which are open to the water spaces of the boiler, with which the tubes are combined. Such boiler or outer vessel may be varied in shape so long as there be a chamber as hereafter described, between the furnace and fire-place and the chimney. K K is a steam boiler, which may be of a square or cylindrical section, or other convenient figure; L is the fire-place, M M M M is a rectangular chamber, there being a number of tubes or hollow surfaces in an upright position, through which the water flows in consequence of the water therein becoming hotter than other parts of the boiler. The heat of the fire passes into the chamber M at N, over the bridge O, at the end of the furnace or fire-place; and the passage P, from the chamber M into the flue or chimney, is situated as low as possible, in order that the greater heat of the vapours may be retained in the chamber M M, for it will be readily understood that the more highly heated vapours or products of combustion will occupy the upper part of the chamber M M, and the draught into the chimney will only carry off the cooler parts of the vapours, the more highly heated being comparatively in a quiescent state, at the upper part of the chamber M; and it is the peculiar arrangement of the chamber M within a steam boiler, when containing tubes or hollow surfaces, and combined with the outlet P into the chimney, so as to leave a considerable space above it (for the more highly heated vapours to be retained in the chamber M), which constitutes the peculiar character of my invention. Z is an opening into the chimney at the upper part of the chamber M M, to facilitate the getting up a draught when first lighting a fire, it being closed at all other times; Y is a steam pipe in connection with the upper part of the boiler, having a stop-cock; this pipe is drilled with many small holes in the direction towards the chimney, by which numerous jets of steam can be projected amongst the tubes, in order to sweep away the dust and ashes when required. I would remark that it is not necessary to have the tubes in an upright position."

Such is the Earl of Dundonald's account of his invention. This boiler is superior to all that have preceded it, and is *identical* with those now in use on board the steamer *Osprey*, with the exception that her boilers have not the opening Z, or the steam pipe Y, both of which would be an improvement. The boilers of the *Atlantic* and *Pacific* differ from the above in having two furnaces, one above the other.

In December, 1845, James Montgomery, of Tennessee, took out a patent for a vertical tubula boiler, which is shown in figs. 14 and 15.

Fig. 13.

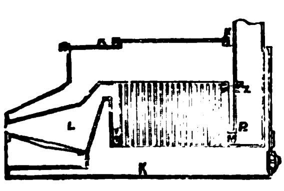


Fig. 14.

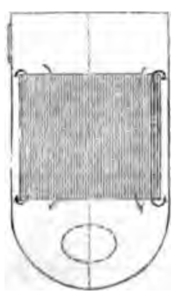
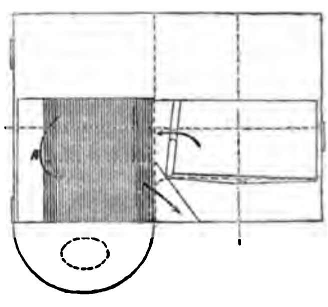


Fig. 15.



His claim is the arranging the fire chamber or furnace of a tubular boiler at the side, so that the heat shall act on the upper half of the tubes, in combination with a diaphragm, or partition, and flue, to carry off the flame, heated air, &c., to act on the lower half of the tubes after acting on the upper half as described.

He also claims the making of the bottom of the boiler of a conical or dished form, with the mud or blow-off valve in the lowest part of the concavity, in combination with the vertical tubes communicating with the bottom, in the manner described, to permit the deposit of the sediment, there being a water space surrounding them (the tubes), to induce circulation of the water up the tubes and down the surrounding space, to wash the sediment towards the mud or blow-off valve, as herein described.

From the drawing and specification the boiler will readily be understood. Its distinguishing feature is the use of the horizontal diaphragm, which, being placed about midway in the tubes, causes the fire to act as stated. Several of these boilers have been used in steam vessels of moderate size, and for stationary engines; they have given much satisfaction, causing a considerable saving of fuel where they have been used in the place of other boilers. *Properly* constructed, this is a very good boiler, but it has no advantages over the boiler of Dundonald, and I think the diaphragm plate was introduced to correct an imaginary evil, as, in Dundonald's boiler, the lower end of the tubes can never be overheated.

Previous to this time there had existed much prejudice against tubular boilers of any kind for marine purposes, but the success attending the introduction of horizontal and vertical tubes in England, and the boiler of Montgomery in this country, called the attention of those interested in marine navigation to them; and when the steamers *Atlantic* and *Pacific* were begun under the direction of Mr. E. K. Collins, of New York, he caused a large number of experiments to be made with vertical tubular boilers for use in salt water. The performance of the steam-boat *Jonas C. Heartt*, with Montgomery's boiler, was carefully noted for several days, being equal in time to a trip to Europe.

It being satisfactorily ascertained that the tubes would not choke up, but, on the contrary, would keep perfectly free from scale, Mr. Collins concluded to adopt some form of vertical tubular boiler; but as the form patented by Montgomery was objectionable, from the necessity of returning the heat below the boiler, to unite all in one common chimney, thereby making a flue arrangement not at all satisfactory, he determined to test the use of vertical tubular boilers without the diaphragm plate, being, in fact, the boiler of Dundonald. After a series of experiments, proving that there was no objection, the boilers of the *Atlantic* and *Pacific* were designed by his Chief Engineer, John Farron, Jun.*

The only difference between these boilers and those of Dundonald is in the furnaces, which are here doubled, one being above the other, caused by the necessity of obtaining more grate surface than could be obtained with one range of furnaces, the objection that had been urged against allowing the heat to act against the whole length of the tube having, by experiment, been found to be without cause. It is not necessary to say that these boilers, so far at least, are perfectly successful; the short passages made by these ships attest the fact. At or about the time these boilers were designed, Mr. Montgomery surrendered his patent, and obtained a reissue, dated August 15th, 1848.

The claims made in this re-issue, and allowed by the examiners at the Patent Office, are in number four. The first claim is for vertical tubes, in connection with a top and bottom chamber, and with side water spaces, made singly or in sections; this covers the boilers of Steenstrup, Hall, and Dundonald. The second claim is for so arranging the furnace outside the tubes that the greatest heat shall be applied at their upper end, and the reduced heat at their lower ends; this claim and method of arrangement appears to be the same as is minutely described by Dundonald in his patent. The third claim embodies the first part of the original patent granted to him; viz., the use of the diagram plate midway in the tubes, as shown in his drawing. The fourth claim is for making the bottom of the boiler conical or dished, in connection with vertical tubes, etc.; this is also a part of Dundonald's patent, for he dis-

* For engravings of these boilers, see *Mech. Mag.*, No. 1398, May 25, 1850.

tinctly states that his boiler may be made cylindrical if desired, which of course gives the dished bottom.

From what has been stated, it will be seen that the vertical tubular boiler has been nearly twenty years in reaching its present position, beginning with the patent of Eve, in 1825, and ending in 1843, with that of Dundonald. I say ending *there*, for I consider that his boiler has all the elements of success. The boiler of Montgomery, as patented in 1845, although equally-as effective if properly arranged, has no advantages as regards economy of fuel, and is simply a modification of the vertical tubular boilers that preceded it, although no doubt patented without the knowledge of their existence.

PROGRESS OF MARINE ENGINEERING IN AMERICA.

Sir,—Since the publication of my paper upon "Ocean Navigation," in No. 1415, I have been favoured (by an obliging reader at Manchester) with a copy of the *New York Courier and Enquirer* of September 21; in fact, published upon the same day, and containing an interesting account of the work now in the hands of the various engineering establishments of that city.

It professes to give a statement of marine engine work *only*, but shows an amount of orders perfectly astonishing even to us; and I much doubt whether any one of our firms could boast of such a list as that classed under the head of the "Novelty Works," employing 1200 individuals, and having orders for eight pairs of engines—the largest of about 900 horses power for a ship of 3000 tons; the smallest about 300 horses power, for a ship of 800 tons.

The principal portion of these machines are of the "side lever" construction, but it appears that the "Allaire Works are constructing a pair of oscillating engines with cylinders 85 inches diameter, and 9 feet stroke = 640 horses power, for a steam ship of 2200 tons, building by Smith and Dimon for Messrs. Howland and Aspinwall"—that the "Novelty Works" are making engines of similar dimensions for the same owners, for the ship *Golden Gate*, of 1800 tons; and, further, that oscillating engines have been tried in the ship *Republic*, on the Pacific coast, and found to answer so well, occupying so little space, being of so little weight when compared with lever engines, that the before-mentioned large engines have been ordered.

Thus, my concluding prophecy is realised—it is *fact*. Our brethren in America are alive to the advantages to be derived from a more efficient and lighter machine than the old fashioned "beam engine," and they will make its superiority manifest, to our utter discomfiture, whenever they come into competition with us in Atlantic navigation. Those who direct the affairs of the Cunard Company, and of the Royal West India Mail Company, have much to answer for, by an outrageous adherence to ancient plans, and a determined blindness to modern improvements. Both these associations may fairly be charged as conducive to the suppression of British talent and superiority; at the same time I freely confess it must be considered as an "error in judgment" only, because their *interest* is too plainly opposed to their past actions.

If you can spare space for the insertion of the whole statement of the *Courier*, I feel convinced that it will do good, and show us that we must be "up and stirring" if we are to compete in marine engineering with our active and enterprising relatives of America.

I have hitherto spoken of the machinery only, and ascribed American superiority to their boilers on board the Atlantic ships. But if there is truth in an able article published in the *Daily News* upon the 11th ult., our *ships* are very inferior to theirs in model and design: "The American ships slip down the Mersey with scarcely a ripple at the bow—the *Britannia* goes bowling along, carrying a sea before her sufficient to swamp a revenue cruiser."

Allow me to correct a paragraph in my former letter relating to the price of steam engines, which I find has been misunderstood.

I did not mean to assert that 50*l.* was a proper price per horse power for "beam engines," but merely to illustrate, that *if* so, "oscillating engines" could be made for one-fifth less, leaving an equal profit. I am aware this is under rather than above the truth.

PRESSURE NOT PUFF.

November 5, 1850.

THE EXTRACT REFERRED TO IN THE PRECEDING LETTER.

The Foundries in New York.

Below we give a statement of the various marine and other large engines now in course of construction at the several machine shops in this city. The first successful attempt to build a marine engine of a large class was that constructed for the Russian war steamer *Kamschatka*, which was followed, after an interval of several years, by the engine of the steamer *Southerner*, of Messrs. Spofford and Tileston's Charleston line. The success of this engine was speedily followed by the construction of others, although it was not until very recently that entire confidence has been felt in the heavy sea-engines turned out by our foundries. The eminent success of the Pacific and Collin's steamers has, however, given an impetus to that branch of manufactures, which is now prosecuted with great activity,—the largest establishments having more orders than they can fill, while new establishments are every day going into operation.

The use of cast iron for shafts and other important parts of the steam engine and gearing has been generally abandoned, and wrought substituted, at much greater cost, but still with economy, as cast iron often proved treacherous, under circumstances which involved an immense loss in damage and delay. It will be seen that several oscillating engines are in course of construction. These engines have been tried with success in the steam-ship *Republic*, now on the Pacific coast, running in Howland and Aspinwall's line, and so well satisfied are those gentlemen, that they are fitting out two new steam-ships with similar engines of the largest class. They occupy less room, and require less weight of metal, than the side lever or beam engine—the piston rod acting directly on the crank.

The building of iron steamers is also carried on to some extent, being confined, however, to vessels of a small class, where it is an object to secure the lightest draught of water possible.

There is perhaps no branch of industry in which there has been so rapid and so healthy an increase within the last five years, as in that which is the subject of this notice. The American machinists have long been celebrated for the excellence and capacity of their river engines, and the marine engines of our builders are rapidly obtaining a similar celebrity.

The following is a list, alphabetically arranged, of the principal steam-engine building establishments. There are several others engaged in the manufacture of small stationary engines, but our object has been to allude chiefly to marine engines:—

The Allaire Works.

This steam engine manufactory and foundry, No. 466, Cherry-street, is conducted by T. F. Secor and John Breasted, lately T. F. Secor and Co., and is one of the oldest and largest establishments in the country, occupying 42 lots of ground, and employing between 600 and 700 men. This establishment has now on hand, and nearly completed, the immense engines, boilers, and other machinery for the steam-ship *Baltic*, one of the four Collins' U. S. mail steamers, of the following dimensions:—Two cylinders, of 95 inches diameter and 10 feet stroke of piston, with four large tubular boilers, with 32 furnaces for burning coal. These engines are among the largest marine engines in the world—they are the side lever marine engines, wrought iron frames, shafts and cranks, wheels, &c. The pistons are of composition, weighing 15,000 lbs., and of great strength.

Also, two oscillating engines of 85 inches diameter of cylinder and 9 feet stroke of piston, for a steam-ship of 2,220 tons, building by Smith and Dimon for Howland and Aspinwall, with four iron boilers; the first pair of engines of any magnitude, of the oscillating plan, built in this country.

Also, two side lever marine engines and boilers of 65 inches diameter of cylinder and 7 feet stroke, for a steam-ship built by W. H. Webb for Spofford and Tileston, together with a number of engines of smaller classes for river boats, factories, &c. Among the latter is a beautiful and compact horizontal engine, to be used in driving the presses of the *Courier* and *Enquirer*.

The Archimedes Works.

Messrs. H. R. Dunham and Browning, proprietors. Their main works are situated at the foot of North Moore-street, N. R., and the branch (where the principal part of the heavy work is done) is located at the foot of 33rd-street, the buildings of which, including the one in North Moore-street, occupy over 50 lots of ground.

This firm are now constructing a large marine engine for the steam-ship *Pacific*, at the ship-yard of Wm. H. Brown, foot of 12th-street, which is the *forty-third* engine which they have constructed for steamers built by Mr. Brown.

They are also building five first-class sugar-mills and engines; eleven substantial steam-boilers, and a number of wrought iron gates for the Navy Yard Dry Dock at Brooklyn, all of which are in rapid process of construction.

They employ over 300 men at all seasons

of the year. Since the first of last January, over 100 tons of iron have been melted at these works each month.

The business of Messrs. H. R. Dunham and Co. has so largely increased within a few years past, that they have found it necessary to enlarge their upper foundry, and are now about commencing operations.

The Chelsea Iron Works.

Messrs. Mott and Ayres, proprietors of the "Chelsea Iron Works," have recently erected several spacious buildings in 26th-street, near the North River; and about the first of last June they resumed their business that had been interrupted by a destructive fire occurring in their works, in 25th-street. They give constant employment to upwards of 300 mechanics, and the amount of machinery and other heavy ironwork turned out in the course of a year is enormous.

At these works is an iron steam-boat rapidly approaching completion, which has been built for the Panama Railroad Company, who intend to place her on some of the small rivers on the Pacific coast. She is 130 feet in length, 22 feet beam, 5½ feet deep, and when light will only draw 13 inches of water. This model craft is to be propelled by two high-pressure engines, and when finished is to be taken apart and shipped to California in separate pieces, which will be riveted together again after they reach their destination.

They have also laid the keel for another iron steamer for the same Company, which is to be 125 feet long, 22 feet and 8 inches beam, 7 feet depth of hold, and will be completed and ready for sea in ninety days. She is also to have two high-pressure engines.

Three small iron crafts, intended for shoal water, are also nearly completed at these works, for the Panama Railroad Company.

Another branch of their business, is manufacturing "*Water Doors*;" an improvement recently invented and patented by Mr. Ayres, the object of which is to keep the fire of ocean steamers cool.—They recently fitted out the steam-ships *Atlantic* and *Pacific* with this excellent improvement, and are now making the same for the *Baltic* and *Arctic*, of Collins' ocean steamers.

There is under way at these works a patent boiler, invented and called "Boardman's Patent," which, when completed, will be sent to Plattsburgh, in the northern part of this state, to be used in an extensive steam manufactory of cloths. It is upon the same principle as the one used at the Franklin Forge in the First Avenue.

A vast amount of gas apparatus is manufactured by Messrs. M. & A., who are constantly overrun with orders for the same.

The Fulton Foundry Iron Works,

Pease and Murphy, proprietors, occupy seven lots of ground on Cherry-street, three on Corlaer's-street, and three on Water-street. The number of men employed in the works is, on an average, 250. The yearly consumption of material in this establishment is 600 tons of cast iron; 700 tons of boiler plate, rod, and other wrought iron; 700 tons coals; 200 tons copper composition, steel rivets, and other materials.

At this foundry there is now building:—One boiler for the steam-boat *Norwich*, North River; two boilers for the steam-ship *Cardenas*, Island of Cuba; two boilers for George Law's steam-ship *Falcon*: one boiler for the steam-ship *Kennebec*, Philadelphia outside route; one boiler for the steam-ferry boat *Independence*, Catherine Ferry; two engines and boilers for the steam-ship *Sophie*, for California; five high-pressure land engines and boilers, of different sizes, from twelve to fifty horses power, for sugar mills; one set of tanks and coal shoots, for the steam-ships *Arctic* and *Baltic*, Collins' line; one 36 inch engine, 10 feet stroke and boiler, for California; one boiler and propellers for the steam-ship *Ontario*, for California; three large lathes for the shop; six tubular boilers, for the Hoe Company and others; one engine and boiler, high pressure, for George Ketchum, besides other work.

Hogg and Delamaters's Foundry,

In west 13th-street, employs about 250 hands. They are now building two large boilers, of great size, for the steam-boat *Hendrick Hudson*, and the machinery for Captain Stoddart's propeller, a vessel of 1200 tons, intended to ply between this city and Liverpool, now in course of being finished, at Perrine, Patterson, and Stacks' yard, Williamsburgh. It will be about 400 horses power.

Also two propellers for parties in Eastport, Maine, for two vessels building there.

In addition to the above, they have in hand a very powerful steam engine, of the largest size, for the sugar house, now in process of erection, on the ruins of Woolsey and Co.'s sugar house, corner of South and Montgomery-streets.

The Minnesota Iron and Brass Foundry.

Messrs. V. G. Audubon and John Stafford have an extensive iron and brass foundry, scale manufactory and machine shop located in 26th-street, between the 10th and 11th avenues, where they manufacture a great quantity of machinery, water and gas pipes.

The buildings of this firm occupy six lots

of ground, and the number of mechanics employed varies from 50 to 75.

The most important feature of their business is receiving vast quantities of copper ore from the Minnesota Mines, along the shores of Lake Superior. Thisarticle is brought to the city in large lumps of immense weight and smelted at these works.

Another branch of their business, on an extensive scale, is the manufacturing bronze castings of every description. They are now finishing a large and beautiful one for Messrs. Appleton's new edifice in Broadway.

Connected with this establishment is a large machine shop for finishing iron railings, and all kinds of iron work, from a rod to an engine.

The principal portion of their copper is sold and used in this city. At present they have several thousand dollars' worth ready for smelting.

The Morgan Iron Works

covers 33 lots of ground, one block entirely and part of another, at the foot of 9th-street, E. R., Charles Morgan proprietor. Employs about 600 men, and is at present manufacturing one pair of marine engines of 66 inches diameter of cylinder, and 8 feet stroke of piston, for Davis, Brooks, and Co., under the supervision of Capt. William Skiddy. The vessel is building by Westervelt and Mackay. One pair of marine beam engines, of 42-inch cylinders, 10 feet stroke, for C. Vanderbilt's new ship, called *Prometheus*, built by Jeremiah Simonson. This vessel is now at the dock, receiving her machinery, and will soon be completed, and will probably be employed in the California trade. One marine beam engine, of 72 inches diameter of cylinder and 11 feet stroke of piston, for a vessel building for the California Steam Packet Company, by Perine, Patterson, and Stack, J. Howerd and Son, agents. One engine of 60 inches diameter of cylinder and 12 feet stroke of piston, for the Norwich and New London Steam-boat Company. Vessel building by Lawrence and Sneeden, under the superintendence of Capt. W. W. Coit, will soon be completed. Two engines of 56 inches diameter of cylinder and 10 feet stroke of piston, for a couple of steamers building, one by Wm. Collyer and the other by Westervelt and Mackay, for Harris and Morgan, New Orleans, intended for the Gulf trade. One engine of 44 inches diameter of cylinder, 11 feet stroke of piston, for Captain J. B. Coyle; to run between Boston and Portland, Maine. Two small sugar-mill engines—one engine of 26 inches diameter of cylinder, for towing canal boats on the Oneida Lake. This is a new trade lately engaged in by one of our enterprising citizens, Geo. A. Hoyt, and bids fair to be a profitable adventure.

Also, a pair of marine side lever engines of 80 inches diameter of cylinder and 8 feet stroke of piston, and an inclined engine of 34 inches diameter of cylinder 9 feet stroke of piston, for the Union Ferry Company.

There is, besides the above, a large amount of small work doing at this establishment.

The Novelty Works.

This steam engine manufactory and foundry, at the foot of 12th-street, conducted and owned by Messrs. Stillman, Allen and Co., is the largest establishment of the kind in this city. There are now employed in those celebrated works 1200 men, in the following departments:—

268 iron founders.	12 hose and belt makers.
15 brass founders.	3 painters.
369 machinists.	6 masons.
242 boiler makers.	31 riggers.
34 carpenters.	38 labourers.
27 coppersmiths.	6 cartmen.
71 blacksmiths.	11 clerks and storekeepers.
9 draughtsmen.	
17 metallic life-boat builders.	6 watchmen.
	24 pattern makers.
21 instrument makers.	

Within the last year, more than one million dollars worth of work has been despatched from this establishment, and Messrs Stillman and Allen have refused as much more in consequence of not being able to attend to it. They have recently been extensively building Life Boats, and it is a branch of their business which will no doubt increase to a great extent.

This establishment has now on hand a large number of engines and other machinery for sugar refiners, &c., besides the following list of engines for new vessels.

The steam-ship *Arctic*, of 3000 tons, two side lever engines 95 in. cylinder, 10 feet, stroke, for E. K. Collins' line.

The steam-ship *Franklin*, of 2300 tons, two side lever engines, 93 in. cylinder, 8 feet stroke, for the Havre and New York Line.

The steam-ship *Humboldt*, of 2600 tons, two side lever engines, 95 in. cylinder, 9 feet stroke, for the same line.

The steam-ship *Florida*, 1300 tons, one side lever engines, 75 inch cylinder, 8 feet stroke, Mitchell's Savanah Line.

The steam-ship *Alabama*, of 1300 tons, one side lever engine, 75 in. cylinder, 8 feet stroke, for the same line.

The steam-ship *Golden Gate*, 1800 tons, two oscillating engines, 85 in. cylinder, 9 feet stroke, for Howland and Aspinwall.

The steam-ship *Columbia*, of 800 tons, two side lever engines, 67 in. cylinder, 5 feet stroke, for the line.

The steam-ship *Berry*, of 1000 tons, one

side lever engine, 70 in. cylinder, 8ft. stroke, for Spofford and Tileston.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING NOVEMBER 7, 1850.

ROBERT DALGLISH, of Glasgow, merchant and calico-printer. *For certain improvements in printing, and in the application of colours to silk, cotton, linen, woollen, and other textile fabrics.* Patent dated May 7, 1850.

Mr. Dalglish proposes to make various additions to the printing machines in ordinary use, so that after, by the application of the colour, the "blanket" has been rendered unfit for use, it may, during the printing operation, be washed, and present a continuous clean surface for receiving the cloth to be printed, by which arrangement the use of a web interposed between the blanket and cloth is dispensed with.

As soon as a piece of cloth has been printed, the blanket on which part of the colour has been deposited, comes in contact with jets of water, which serve to loosen the colour. It next passes under sets of brushes, which remove a portion of the water, thence under a pressing and sponging roller, and finally over an endless web to a steam chamber, or over rollers heated by steam, which dry and fit it for use, after which it again undergoes the cleansing and drying operations.

Mr. Dalglish observes that he is aware that waterproof "blankets" have been previously washed without removal from the printing-machine; but this was effected during a stoppage for the purpose, and consequently involved a loss of time; and, moreover, that it has been attempted to wash in a similar manner the grey or unbleached cloth interposed between the "blanket" and material to be printed, which he mentions in order to have it understood that he makes no claim thereto. He disclaims also any of the mechanical parts of his own apparatus, separately and individually considered, but claims—

The so arranging machinery used for printing or applying colours to silken, cotton, linen, woollen, and other textile fabrics, that the "blanket," technically so called, shall be washed during the printing operation, and present a continuous clean surface. thereby dispensing with the employment of any interposed material between the blanket and fabric to be printed.

GUSTAVE EUGENE MICHEL GERARD, of Paris, France. *For improvements in dissolving caoutchouc (India rubber) and gutta percha.* Patent dated May 7, 1850.

The object of this invention is, by the employment of certain specified solvents, to produce solutions of India rubber and gutta percha which shall be perfectly plastic, but non-elastic, and which, on evaporating the solvent, shall return to their natural state. For this purpose, the patentee employs sulphuret of carbon, chloroform, sulphuric ether, naphtha, spirit of turpentine, &c., in combination with from five to fifty per cent. of alcohol, or spirit possessing similar qualities, such as spirits of wood or potatoes, which he mixes with the material to be dissolved in certain proportions varying with the thickness of solution required. India rubber is dissolved in one or two days, and gutta percha (which is warmed in the process) in from two to four. The alcohol introduced into the body of the material entirely disintegrates and destroys the cohesion of its particles, thus allowing any impurities to settle or float on the surface, on removing which the caoutchouc or gutta percha is found in a perfectly pure state.

The patentee observes, that the principle of his invention is the causing of certain materials to be introduced into the body of the rubber by means of a solvent, these materials having the property of disuniting and destroying the adhesion of the particles of the rubber, and being employed either separately or in combination with a solvent.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Matthew Hodgkinson, of Red-street, near Newcastle-under-Lyne, Stafford, mine agent, for improvements in furnaces or apparatus for smelting ores and minerals, and for the making of pig iron. November 2; six months.

Victor Emile Warmont, of Neuilly, Seine, France, for improvements in dyeing wool and other fibrous materials and fabrics. November 2; six months.

Joseph Christian Davidson, of Yalding, Kent, brick-maker, for improvements in lime and other kilns and furnaces. November 2: six months.

John Matthews, of Kidderminster, foreman, for improvements in sizing paper. November 2; six months.

Jonas Bateman, of Upper-street, Islington, cooper, for improvements in life-boats. November 2; six months.

Archibald Slate, of Woodside Iron Works, Dudley, for improvements in canal navigation. November 2; six months.

Pierre Antoine Auguste de la Barre de Nanteuil, of Leicester-street, Middlesex, for improvements in propelling carriages. (Being a communication.) November 2; six months.

William and Colin Mather, of Salford, engineers, and Ferdinand Haselowsky, of Berlin, Prussia, engineer, for improvements in machinery for washing, steaming, drying, and finishing cotton, linen, and woollen fabrics. November 2; six months.

John Borland, of Norfolk-street, Strand, engineer, for certain improvements in weaving machinery. November 2; six months.

John Slate, of Wandsworth, Surrey, accountant, for improvements in stoves and furnaces, and in chimney-pots and regulators. November 2; six months.

John Tatham and David Cheetham, of Rochdale, Lancaster, machine-makers, for certain improvements in the manufacture of cotton and other fibrous materials and fabrics composed of such materials. November 2; six months.

Richard Clyburn, engineer to the firm of D.

Maclean and Son, of St. George-street East, Middlesex, for improvements in wheel carriages. (Being partly a communication.) Nov 2; six months.

James Black, of Edinburgh, machine-maker, for a machine for folding. (Being partly a communication) November 7; six months.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of Fleet-street, patent-agents, for improvements in railways. (Being a communication.) November 7; six months.

William Fairbairn, of Manchester, Lancaster, civil engineer, for improvements in cranes and other lifting or hoisting-machines. November 7; six months.

William Crane Wilkins, of Long-acre, Middlesex, engineer, for an invention for lighting and in apparatus for lighthouses, signal, floating, and harbour lights. November 7; six months.

Samuel Edwards, James Ansell, and Patrick Heyns, of Shadwell, Middlesex, engineers, for certain improvements in obtaining and applying motive power, and in pumps. Nov. 7; six months.

George Frederick Morrell, of Fleet-street, London, gentleman, for improvements in obtaining and applying motive power, and also in pumps. November 7; six months.

John Alexander Lerew, of Boston, America, gentleman, for certain improvements in sewing machines. November 7; six months.

Benjamin Guy Babington, of George-street, Hanover-square, Middlesex, Doctor of Medicine, for improvements in preventing incrustation of steam and other boilers. November 7; six months.

Robert Clare, jun., of Exchange-buildings, Liverpool, gentleman, for improvements in the manufacture of metallic casks. November 7; six months.

John Robinson, of Stepney, Middlesex, engineer, for improvements in lifting and moving fluids and other bodies, and in apparatus for steering ships and other vessels. November 7; six months.

David Christie, of St. John's-place, Broughton, Salford, Lancaster, merchant, for improvements in machinery or apparatus for preparing, carding, spinning, doubling, twisting, weaving, and knitting cotton, wool, and other fibrous substances, also for sewing and packing. (Being a communication.) November 7; six months.

Robert Lucas, of Furnival's-inn, London, mechanical draughtsman, for improvements in telegraphic and printing apparatus. (Being a communication.) November 7; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Oct. 31	2507	Swaine and Adeney	Piccadilly, Whip Manufacturers	Universal whip-socket.
,,	2508	C., A., and T. Ferguson	Mast House, Millwall, Poplar	Gun carriage to facilitate the training and working of heavy guns.
,,	2509	Chapman and Son	Frith-street, Soho-square	Moveable button.
,,	2510	Laurie and Marner	Oxford-street, Carriage-builders	Invisible carriage step.
,,	2511	Earl, Smith, and Co.	Sheffield	The triple file.
Nov. 1	2512	William Laschallas	Budge-row	Pentagon envelope.
,,	2513	Isaac Naylor	Burton, near Barnsley	Alarm gun.
,,	2514	John Fernihough and Sons	Victoria Works, Dukinfield	Double furnace smoke-burning horizontal tube steam boiler.
2	2515	William Curtis Hugman	Great Ormond-street, Queen-square	Portable folding truss.
4	2516	George Percy Tye	Birmingham	Hyacinth glass and support.
,,	2517	David Duthoit and Job Roof	Finsbury Pavement	The aerial tent.
5	2518	Thomas Lambert and Son	Short-street, New-cut, Lambeth	Economic fountain lamp.
,,	2519	Robert and John Garrard	Loman-st., Gravel-lane, Southwark	Nautical glazed felt hat.
,,	2520	William Edward Jenkins	George-street, Euston-square	Embossing machine for stamping with ink paper and other material.
6	2521	Edouard Auguste Jaillard	Bedford-street, Strand	Travelling case.
,,	2522	Browning and Rigby	Adelphi Iron Works, Salford, Engineers	Compound cylinder steam engines.

CONTENTS OF THIS NUMBER.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. ORMEROD AND SHEPHERD'S PATENT APPARATUS FOR CHANGING THE POSITION OF CARRIAGES ON RAILWAYS.

Fig. 1.

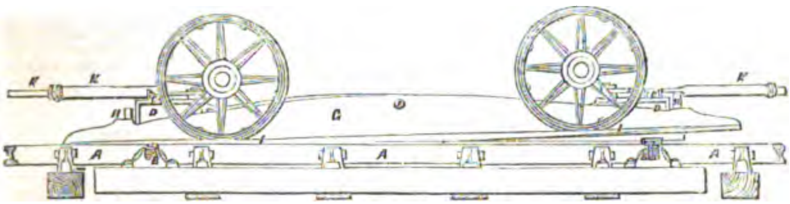


Fig. 2.

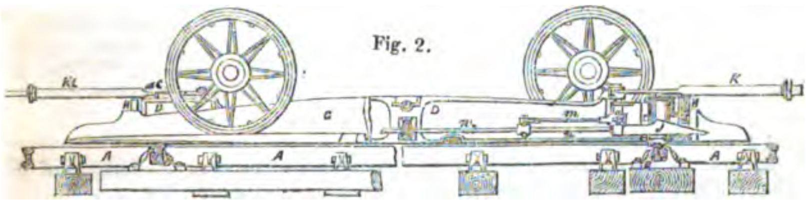
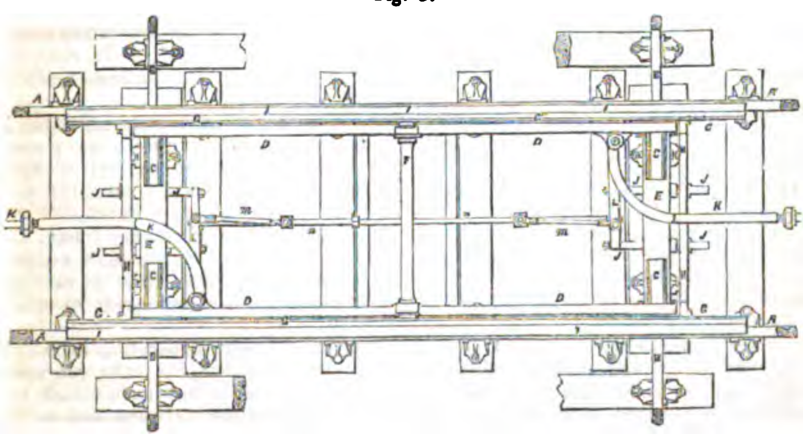


Fig. 3.



MESSRS. ORMEROD AND SHEPHERD'S PATENT APPARATUS FOR CHANGING THE POSITION OF CARRIAGES ON RAILWAYS.—(SEE ANTE, P. 119.)*

The principal advantages by which the improved traversing trucks of Messrs. Ormerod and Shepherd are distinguished from all others, and from which their superiority arises, are, that the carriage to be removed may be received, sustained during the traverse, and discharged, by means of one and the same pair of rails,—laid continuously, or without break, on an oscillating frame—and that the carriage may be thereby transferred from one line of rails to another, without disturbing the fixedness of the permanent rails.

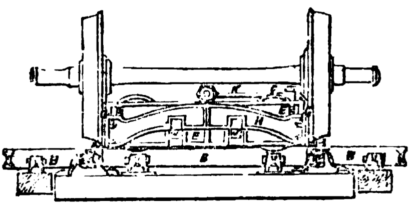
Description of Engravings.

Fig. 1 represents a side elevation of the truck, showing the oscillating frame in the inclined position for receiving or discharging the carriage.

Fig. 2 is half a side elevation, and half a longitudinal section of the truck, showing the oscillating frame in the horizontal position for transferring the carriage to be removed. Fig. 3 is a plan of the truck.

Fig. 4 is an end elevation.

Fig. 4.



AA are the permanent rails of the line.

BB are the transverse rails, fixed at such a level as to allow the flanches of the wheels, CC, of the truck, to pass over the permanent rails of the line.

DD, and EE, are the sides and ends or framing of the truck, supported by four wheels, CC, running upon the traverse rails already described.

By the sides DD, of the truck, is supported the axis F, upon the extremities of which axis are secured the two sides, GG, of the oscillating frame; HH are two cross pieces, connecting the ends of the two sides, GG, of the oscillating frame together. To the sides GG, of the oscillating frame, are attached the rails, II, upon which the carriage is supported during its removal from one line of rails to another.

The raising or lowering of the oscillating frame, together with its rails, II, is effected by two pairs of wedges, JJ, acting upon the cross connecting pieces, HH; and through the medium of the levers K and L, and rods *m* and *n*, either end of the rails II, may be depressed, and made to meet and rest upon the permanent rails, AA, of the line.

On the carriage being received upon the rails, II, of the oscillating frame, the oscillating frame must be brought into the horizontal position by means of wedges, and after the truck and its load are removed to the desired line of rails, the carriage may then, by the same means, be allowed to descend upon those rails in either direction, as required.

The patentees call attention to a modification of their apparatus, in which the oscillating frame is supported on *two* axes. When a carriage is to be run upon the truck, so constructed, the end of the truck opposite to that upon which the carriage is received must be raised, so that the ends of the rails attached to the oscillating frame may be depressed, and made to meet and rest upon the permanent

* Manufactured by Messrs. Ormerod and Son, St. George's Foundry, Manchester.

rails of the line. The carriage being received upon the truck, the raised end of the frame being lowered, the oscillating frame will assume the horizontal position for traversing, resting upon the two axes. The carriage may thus descend from the truck in either direction, as required.

W. B. JOHNSON.

Manchester, October 27, 1850.

MATHEMATICS AND COMMON SENSE.

Sir,—Doubtless ridicule and vituperation are weapons more easy to manage than argument; they are not, however, very destructive, and therefore I hope to survive the *withering* castigation which I have received by their means at the hands of Mr. John Locke, senior.

My object is to obtain the recognition of what I deem to be *truth*, and on that account I set aside all personal considerations as unworthy of notice. I must, however, blow away a little of the smoke which my opponent has raised, in order that the state of the contest may be more clearly seen. To this end I will hastily review his communication, picking out the points requiring notice, as well as I can, from among the personalities, before taking up again the real question at issue.

Imprimis, and generally, let me ask why Mr. John Locke, senior, took so much pains to scold me, when he was about to (as he does in the latter part of his article) concede nearly all that I pleaded for? *E.g.* :—

Mr. John Locke, senior.	*James Rock, junior.*
"Philosophers of the 'senior class' view science and method as one—methods more or less perfect are only sciences more or less perfect."—P. 346, col. 1.	"In one word, it (logical, or mathematical science) is method."—P. 310, col. 1. "The point that I would contend for is this, that there may be other methods of thought not recognised as scientific."—*Ibid.*
"There is a large amount of traditional science in our workshops—often, indeed, expressed with a peculiar technicality that renders it difficult to seize its import——imperfect, very imperfect indeed it is, but as far as it goes, it is to all intents and purposes, science."—P. 346, col. 1.	"Many merely practical men make use of all the fundamental truths of those (logical and mathematical) sciences without even knowing them to be such."—P. 310, col. 2.

So far, Mr. John Locke, senior, appears to think pretty nearly what I think, and to this extent at least there is no need of the wider generalisation, which I hinted at but did not attempt.

Particularly, allow me to observe that

Paragraph 1—is personal.

Par. 2—is a baseless assumption so far as I am concerned.

Par. 3—is chiefly assumption; as to the definition therein demanded, more presently.

Par. 4—enforces the demand for a definition.

Par. 5—is witty.

Par. 6—is an argument *ad hominem*, not at all *ad rem*.

Par. 7—objects to my idea of the legitimate use of science. This shall be treated of in its place.

In passing, I may remark, that I had a faint idea of the difference between "pure" and "mixed" mathematics before I read the gratuitous explanation contained in this paragraph and the succeeding one, No. 8; and further, that the word "pretensions" mentioned in the latter, was not mine.

Par. 9—asserts the existence of impertinence and charlatanism, as well on the side of science as on that of common sense.

Par. 10—objects to my definition of the inventive faculty, and supplies another which must be noticed presently. It also assumes that I would confine myself under certain especial disadvantages, which I have no "especial" affection for; and that I have given "advice" which I do not remember ever to have

given. It then supplies me with two excellent illustrations in support of my views.

Par. 11—concedes, though not amicably, nearly all that I contended for in my former article.

Par. 12, and last—shows that the writer must have been misled as to the intention of my "strictures" by the delay which took place in their publication. They are dated October 7, and refer to that portion of the "Notes," which was contained in the Magazine published on the 5th.

I have endeavoured to be brief in this review, and I hope that you think I have been successful. I beg leave to add, that had I seen Mr. Davies' concessions to "Common Sense" in the succeeding part of his "Notes," before writing my article, I should probably not have done anything to cause the ghost of John Locke to "revisit the glimpses of the moon."

From the foregoing analysis it will be seen that there are three points upon which I am especially challenged by Mr. John Locke, senior:—

1. As to a definition of common sense.
2. As to the legitimate use of science.
3. As to the definition of the inventive faculty.

As regards the first, I reply, that "Common Sense" was attacked without being defined, and that I was not bound to furnish a definition in defending it. Definitions can prove but little to "science," since they are only appeals to common sense—mere propositions without demonstration; and as M. Guizot truly says,* "It almost invariably occurs that in the usual acceptation of terms most in vogue there is more truth than in the more rigorous, and apparently more precise, definitions of science."

However, as Mr. John Locke, senior, like old Socrates, says, "*Define,—define!*" I will attempt a definition of "Common Sense."

Common sense, then, as I take it, is the general *understanding* of mankind, which is common to all, as far as anything else is, or can be common among beings who are individually different.

By understanding, I mean active consciousness — what the veritable John Locke calls "right understanding," which "consists in the perception of the visible or probable agreement of ideas."

I mean that faculty of the mind which, in the reader of these lines will become conscious of their probable truth or error, and thus enable his judgment to receive or reject the views which I advance.

I mean that faculty to which men of science look for admission of the truth of their definitions, and whence they draw their axiomatical propositions.

The faculty to which they appeal as to their correctness, at every step of their processes, and without which science itself never could have been.

I think I might now fairly ask Mr. John Locke, senior, for a definition of his "ladye love," "science," which he has omitted to give, although complaining of a corresponding omission on my part. In order that I may keep as clear of "shuffle" as possible, I will endeavour to supply this hiatus; and thus, so far as I am concerned, leave no ambiguity as to the meaning and intention of either of the terms which my present opponent has, contrary to my ideas, placed in opposition.

Science, generally, of course signifies knowledge in general. In my former article I wrote of logical and mathematical science, and I now confine myself to these.

By logical science, I understand any rule or system of rules by which any reflecting person is in the habit of arriving at conclusions on given subjects; that rule or system of rules having been adopted as such in consequence of previous experience of its utility as a method of forming correct judgments.

Whence it will be seen that I consider a person a logical thinker if he arrive systematically at just conclusions, whether he use Whately's or any other published system, or one of his own formation; and that I look to the understanding, or common sense and experience, as the only safe guide in the formation of any such system of rules.

By mathematical science, I understand that knowledge of the properties of number and figure which has been derived from experience and the understanding, and extended by the assistance of the imagination—the well-understood results of experience in minor cases furnishing the basis for more extended operations.

* Hist. Civiliz. in Europe, p. 27 (Chambers' Edition).

This—more or less, according to individual capacity and application—I believe that every man has done, and may do for himself; but I should consider it a very *uncommon* sense that would advise the neglect of what is generally called mathematical science, when it is known, or can be easily proved, that such science is an accumulation or record of the results which have arisen from the use of so much of the common sense, mental experiment, and judgment of mankind, as has been employed in the consideration of the properties of figure and number during a long series of centuries.

Most useful, indeed, and most valuable is mathematical science, and happy is he who possesses an extensive acquaintance with it, and viewing it not as an end, but means, does not think it beneath the dignity of his intellect to *apply* it in such manner as may tend to the common good of mankind. This brings me to the second point upon which Mr. John Locke, sen., joins issue with me; viz., the "legitimate use of science." Mr. L. restricts my meaning to science as applied to physics. My own words are: "When the thing has been *thought* or *done*, let science record the process, and thus facilitate its repetition. To deduce formulæ from experiment is its legitimate use; although even in this, *as regards physics*, its value is frequently uncertain." I was writing of logical as well as mathematical science, and of pure as well as mixed mathematics. I by no means intended to confine myself to physical considerations, nor do my words express any such intention. I have said, that "to deduce formulæ from experiment is the legitimate use of science." Mr. John Locke, sen., says that it is not; but then he begs the question by perverting my meaning. In support of my assertion I would remark, that as I view it, every tentative method of investigation is to be considered experimental. The "*reductio ad absurdum*"—the adjustment of the syllogism—the transposition of imaginary figures—are none the less experiments because they do not require the use of the crucible or the blow-pipe. The true object of the use of science, I hold to be the advancement of human knowledge. In what better way can the man of science do this than by recording the process by which he, after due trial, has attained some useful result; and what is this but the deduction of a formula to facilitate a repetition of the operation?

And now let me notice the third point of difference between Mr. John Locke, sen., and myself; viz., as to the definition of the inventive faculty.

In this there is rather the appearance of difference than the reality. I am ready to admit that the inventive is very near akin to the poetic faculty, and that invention is as nearly allied to the imagination as to the reason. But then I aver that the expression which I used to describe the inventive faculty (viz., the perception of relation among given facts), presupposes the prior perception of the facts themselves, whether external facts or merely ideas, and that the imagination may give rise to this "perception of relation" by placing the facts in new positions; but in any case, a knowledge of the properties and qualities of things must be presupposed also; and for this the inventor must be indebted to his understanding and experience. Only when the invention may happen to be the result of accidental combination can it be otherwise; and even in this case, previous knowledge and understanding are generally necessary to the true appreciation of the circumstances first presented to the mind accidentally, in order that the observation of those circumstances may constitute or lead to a discovery.

I am afraid, Sir, that I am trespassing too much upon your valuable space, and I must therefore, in conclusion, content myself with only re-stating the position which I took up in my former article, in order that it may receive the benefit of such light as the foregoing remarks may be calculated to throw upon it.

Common sense was arraigned as a heretic and rebel; I, as one of her adherents, ventured, as I had done before, to espouse her cause. I quarrelled not with science—I admitted its value; but since it was clear to me that science owed filial duty to *past* common sense, inasmuch as without it, science could not have existed, it seemed to me that it ought to concede to *present* common sense more than it, or rather its possessors, appeared inclined to concede; and I argued that the method of the man who formed his own system or method, had as much right to be termed scientific as those

methods which men "*soi-disant*" of "science" consider their own peculiar property, and hold up "*in terrorem*" to the uninstructed.

In addition to this statement I wish to remark, that could all logical and mathematical science be swept away to-day, only let the powers of the human mind and the conditions of things continue, and the whole of those sciences might be reconstructed. But let the common sense or understanding of mankind be destroyed, then all present science would become useless, and no further development of it could take place, because the faculty in which it had its origin, and by which its use is preserved, would be lost.

And notwithstanding that I hold this, perhaps, heretical view of the subject, I appreciate the value of science, and take no little pains to introduce it into "the workshop."

A word or two at parting to Mr. John Locke, sen.

I use the personal pronoun "I" so frequently in my communications only because I am stating my own views, and do not wish, by writing in the "third person," to assume them as absolute truth.

I would ask Mr. L., should he favour me with another article, to refrain from assuming so much more from my words than I intend, or they express, and not to place so much stress on the necessity which I am under, and hope long to remain under—that of signing myself

Yours truly,

JAMES ROCK, JUN.

Hastings, Nov. 4, 1850.

ON MR. BILLS'S RULE FOR CUBICS.

Sir,—In a letter, dated Sept. 16th, 1850, your able correspondent, Mr. SAMUEL BILLS, of Hawton, favoured me with a statement of his rule for cubics. His statement was, however, unaccompanied by any investigation, and, consequently, I regarded it then, as I do now, not as a new solution of a cubic, but as a very neat mode of exhibiting an expression for its roots.

Being much struck with the simplicity of his formulæ, I expressed, in the letter by which I answered his, the pleasure that I should feel in introducing his process into my "Notes" on Equations. Mr. BILLS in his reply (dated Sept. 26th, 1850) informed me that he had transmitted his process to this Magazine; and accordingly it appeared in the ensuing Number (*vide supra*, pp. 252-3.)

A gentleman, whose valuable contributions to this Journal entitle him to the respect of all lovers of mathematics (Mr. WILKINSON, of Burnley), has, in a letter which I forwarded to you, and which you published in your last Number (*sup.* p. 347), shown the ultimate identity of Mr. BILLS's formula with that of MURPHY, and has thus confirmed its accuracy. But I quite agree with Mr. WILKINSON in considering it as an *adaptation* of MURPHY's formula. Perhaps it would be more strictly correct to say, that it is an adaptation of the general expression for the roots of a cubic. For there is only one such general expression, although we may arrive at it in a variety of different ways, each of which is termed a *solution*.

To Mr. WILKINSON's investigation we may add, that, between Mr. BILLS's expressions and those of MURPHY (The. of Equa., pp. 50-1), there subsists the relations

$$3\,A = a^1, \text{ and } 2\,C = b^1.$$

Mr. BILLS's is a good mnemonic rule for arriving at this general expression, but it cannot be called a solution of the given equation. Supposing that general expression *known*, it teaches us how to form it. But, supposing it *unknown*, Mr. BILLS has not given us any new means of arriving at it, nor has he shown how his processes are connected with any new method of solution. Until he has fulfilled the latter condition, his process must be regarded, not as a new method of solving cubics, but as a new and neat mode of exhibiting or arriving at the known symbolical expression for their roots.

Mr. BILLS has, naturally and pardonably enough, taken a favourable view of his own rule, and, as has been seen, to a certain extent I agree with him in that view. But, with respect to its practical application, I am at issue with him. When we write a_1 for $\frac{1}{3}a$, and b_1 for $\frac{1}{2}b$, we disguise, but do not dispense with, a *division*. Additions and subtractions, besides other operations, are involved in the formation of A, B, and C. Now, in the numerical example given by Mr. BILLS, all the difficulties arising

from the above circumstances are withdrawn from our view. For when, as in that example (*sup.* p. 252), a and b are both multiples of 3, *fractions* are avoided in the formation of a_1 and b_1. But, in general, the last-named two quantities will, when the coefficients of the given cubic are integers, involve fractions whose denominators are 3. And so troublesome are these fractions, that a rule has been formed by which (see Barlow's Tables, p. xxiv. of the Preface to the edition of 1814), in transforming a general cubic into another whose second term is zero, such fractions may be avoided. Again, Mr. Bills has suppressed the *numerical* multiplications, subtractions, &c., which his example requires, ere we can arrive at the numerical values of A, B, and C. But, unless *all* the numerical operations are exhibited, it is of course impossible to form a true estimate of the practical value of any proposed process. My friend Professor Davies has shown (see *Mathematician*, vol. iii., pp. 80, *et seq.*), and in no less an instance than that of the great Lagrange, whose treatment of a certain geometrical problem he there gives, how utterly useless for practical purposes the neatest symbolical expression may be, and how little we can judge of the real difficulties of a problem by a contemplation of results merely symbolic.

So far as the practical solution of numerical equations is concerned, the process of Horner is probably the only one which, at the present time, any one would think of applying generally. In the particular case where the rigorous expression for the roots of a cubic is required, I have (*Mech. Mag.*, vol. lii., pp. 487 *et. seq.*) given a practical numerical method, from which I have banished all algebraic symbols, which may be worked arithmetically, and which involves in itself a means of ascertaining the nature of the roots of the given cubic.

When applied to such an example as that given by Mr. Bills, my rule admits of an important simplification, suggested by his mode of treating that example, and consisting in this; that, *when a and b are multiples of 3, all the multiplications and divisions by 3, contained in my general rule, may be dispensed with, provided we commence our operations with a_1, b_1, and c, instead of a, b, and c.* Thus we may work the example in question as follows:—

-2	6		-22
-2	-2		-2
4	-12		44
6	-22	$6^2=$	36
-2	$2)10$		8
-2			-2
4			-16
	$5)^2=$		5
$\left.\begin{matrix}8\\2\end{matrix}\right\}$	.... ± 3		9

-4 whose cube root $= -\sqrt[3]{4}$

2 .... $= \sqrt[3]{2}$

-2

$$\therefore\ x = 2 + \sqrt[3]{4} - \sqrt[3]{2}.$$

In this process it will be observed that no algebraical symbols are employed.

I shall now give an example in which neither a nor b are divisible by 3. In such a case Mr. Bills will probably find that his ingenious symbolical formula becomes too much encumbered with fractions to be of practical utility.

Ex. 12. Solve the cubic

$$x^3 - 7x^2 + 14x - 20 = 0,$$

(Davies, *Hutton*, vol. i., p. 200, Ex. 2, 2nd instance.)

My rule gives the following process:—

			-60
			-7
			420
-7	$14)^2=$		196
-7	-7		
49	-98		224
42	-180		7
7	$2)82$		1568
-7			
	$41)^2$	$=$	1681
-49	± 57	$=$	$^{\frac{1}{2}}(3249$

$98 \times 3 = 294$

$48 = 3 \times -16 \quad -49$

$-343)^{\frac{1}{3}} = -7$

$-1)^{\frac{1}{3}} =$ .... -1

-7

-15

$\therefore\ x = 5.$

I have before solved this numerical example (see *Mathematician*, vol. i., p. 197), but I have given the solution a form slightly different from that hitherto followed. The only actual operations suppressed are the involutions and evolutions. The multiplications by 3 are performed, as it were, by inspection. On referring to the work and place just cited the reader will see that there are some not uninteresting relations between Mr. Bills's formulæ and mine. Thus we may obtain

$$9A = a', \; 9B = b', \; \&c.$$

In these remarks upon Mr. Bills's paper, I hope that, although I have expressed my opinions freely, yet that I have done so with the respect which I feel for his abilities; and that, notwithstanding the cessation of a work (the *Mathematician*) to which he has contributed, I may often have the pleasure of meeting with his name on other scientific pages.

I am, Sir, yours, &c.,
James Cockle.

2, Pump-court, Temple, November 2, 1850.

Postscript.—The following corrections should be made in papers of mine published in the Supplementary Number to vol. iii. of the *Mathematician* (the final Number of that work).

Page 29, art. 5, line 5, 2d. term, *for* $n-1$ *read* $n-3$.

P. 30, paragraph 8, line 1, *for* z read x.

P. 34, line 7, *for* $(x_2^q - x_1^q)$ *read* $(x_2^q - x_1^q)^2$.

P. 44, line 10, *after* rectilinearly, *read* intersected.

P. 45, in the statement of the Exercise

$$for \; \frac{b^2}{a} \; read \; \frac{b^2}{3a}.$$

[This Exercise as originally stated (*Math.* vol. iii., p. 224), is correct]. Also at

P. 46, of the "Supplement," just alluded to, and at line 5 from the bottom of my solution of the Exercise in question, *for* 2 *read* z.

PROGRESS OF MARINE ENGINEERING IN AMERICA AND ITS RETROGRESSION IN ENGLAND.

Sir,—The letters of your correspondent, "Pressure not Puff," in Numbers 1415 and 1422 deserve the serious consideration of every one who cares for the maritime superiority of Great Britain.

He justly charges those who direct the affairs of the Cunard and Royal West India Mail Companies with being conducive to the "suppression of British talent and superiority;" but he is far too charitable when he attributes their outrageous course to any pardonable "error in judgment," on the assumption, that "their *interest* is too plainly opposed to their past actions."

That their wilful blindness to modern improvements is opposed to their true interests comprehensively viewed, I believe; but their interest, in a narrow view of it, stands in a peculiar position, out of the regions of common sense.

The exceedingly absurd report of the Committee of the House of Commons on Packet Service, which was presented to Parliament on July 27, 1849, recommends, "That in the event of contracts being renewed without public tender, a most strict and searching inquiry should be instituted by some responsible department of the Government into the cost of the execution, and the manner in which the service has been performed, *and into the profits resulting from the several transactions to the Companies, by which they have respectively been carried on.*"

It appears by the Royal West India Mail Company's Report, at their last Half-yearly Meeting, that the Government treated with them for a renewal of their contract in accordance with this ludicrous recommendation; and, after having had their books and accounts submitted to investigation, *a snug private bargain was made* for ten years, at the rate of 270,000*l.* per annum.

That there was anything corrupt in "the bargain," is not insinuated; but *whilst competition was eluded*, it is impossible to conceive any test of the value of a service to the public so radically erroneous as its unprofitableness to the contractors. The reverse would be a more true test. The Royal Mail Company easily showed to Government the unprofitableness of their business hitherto—*but its unprofitableness arises from its inefficiency, and from the costliness of conducting it with unsuitable ships and with obsolete machinery.* Is it to be wondered at that, whilst such a convenient principle of Government dealing with contractors exists, Directors care nothing for improvements; and having

"conquered the Chancellor of the Exchequer to their use," they soar above those contemptible little things—the laws of nature. Only imagine such a principle of appraisement carried out in other matters, and that it should be decreed that those workmen who use the worst tools, and consequently produce the dearest goods, should get a higher price for their commodities than their industrious and more skilful neighbours. It is monstrous!

The Collins (American) Steam Packet Company (one of whose chief shareholders, Mr. William Brown, was a member of the Committee of the House of Commons, which gave the sapient recommendation of the basis on which contracts should be made,) must be in raptures at finding the Royal West India Mail Company emboldened by their happy partnership with Government into disregard of those modern applications of marine engineering science which would make their service efficient and their competition on the Atlantic formidable.

The British public are the sufferers in purse and in character.

I am, Sir, yours, &c.,

"1850 NOT 1838."

Nov. 13, 1850.

SIR F. C. KNOWLES' IMPROVEMENTS IN THE MANUFACTURE OF IRON.

We are much gratified in being able to announce to our readers that the problem of the successful reduction of the rich primary ores of iron has at length been solved. This has been accomplished with the peat coke of Dartmoor, by Sir Francis Charles Knowles, Bart., and a peculiar process of his own invention, the details of which we are not, for the present, able to give; but its extraordinary power will be appreciated by our readers, when we state that the pressure of the blast used at no time exceeded 6 oz. to the square inch; yet this was found adequate to bring down, with profuse rapidity, a rich gray cast iron. The iron produced (of which we have samples) is uncommonly strong, yet soft and ductile under the hammer, and, in its fracture, presents the valuable peculiarity of a highly homogeneous structure. It has been submitted to competent judges, and pronounced to be of very superior quality, worth, at the least, from 5*l.* 10s. to 6*l.* per ton; and we are given to understand that iron of a much higher value can be produced by the process of Sir Francis. He is already favourably known by his applications of chemistry to this branch of metallurgy, and we augur well for the fortunes of the firm which acknowledges as its head a gentleman so intimately acquainted with every branch of science essential to its success. Preparations are, we understand, in progress for the erection of large blast-furnaces, and an extensive trade in charcoal, iron, and steel; and we congratulate the county of Devon on the prospect which this new development of its vast industrial resources opens up to its fortunate possessors. We are informed that Sir Francis Knowles will be able, by his processes (which are secured by patent), to produce every variety of iron and steel of the finest quality, so as to render Great Britain quite independent of foreign countries for those important raw materials of manufacture.—*Mining Journal.*

PROCESS OF MAKING MALLEABLE BRASS.

It is known that common brass containand from 71·9 to 65·8 per cent, of coping from 27·4 to 31·8 per cent. of zinc, per, is not malleable while hot, but that articles of it must be made by casting. As it would be of great importance in many branches of industry to have an alloy of this kind that could be worked while hot, like malleable iron, the information that such an alloy exists must be welcome to artists. As far as I know, the first specimens of malleable brass came from England to Hanover, and the first account of the analysis of this alloy was published by the *Gewerb-Verein* of Lower Austria, at Vienna. The results gave a composition of 34·76 zinc and 65·03 copper, with traces of lead.

On the basis of this analysis, M. Machts, proprietor of a manufactory, made larger specimens of the alloy in question, and found that, by melting together 33 parts of copper and 25 parts of zinc, there was a loss of three parts; thus making 60 per cent. copper and 40 per cent. zinc. It differs from the English specimens by containing a larger proportion of zinc, and possesses, according to M. Machts, the precious property of malleability in a higher degree than the English specimens.

A piece of "*yellow metal*," similar in colour to this alloy, was found, on analysis, to contain 60·16 copper and 39·71 zinc, which is the composition of malleable brass. It also showed great density or solidity.

I caused an alloy to be made by melting together 60 parts copper and 40 parts zinc, which had the following properties:—The colour was between that of brass and tombac, it had a strong metallic lustre, a fine, close-

grained fracture, and great solidity (density). Its specific gravity at the temperature of 10° Celsus, was 8·44; by calculation it should only have been 8·08; thus showing that in the formation of the alloy a condensation must have taken place. Calculation shows that the alloy may be considered as a determinate chemical combination, for the results of the analysis very nearly accord with the assumption that it may be considered as composed of 3 atoms by weight of copper, and 2 atoms by weight of zinc (3 Cu + 2 Zn). The hardness of the alloy is the same as that of fluor spar; it can be scratched by apatite (glass), consequently its hardness is =4. The alloy is harder than copper, very tough, and is, in a properly-managed fire, malleable; so much so that a key was forged out of a cast rod.

These important properties of this alloy warrant an expectation of its application to many purposes in the arts, and it would appear that they depend on its definite chemical proportions. Agreeably to the directions of M. Feyerabend, care must be taken in melting together the metals, not to permit too great a loss of zinc to take place, lest the proportion between the metals should be altered, which might not be without effect on the important properties of the alloy. With this view, it might be advantageous in practice, in place of zinc, to add, in melting a proportionate mixture of brass to the proper proportions of copper. An alloy prepared in this way gave, on analysis, 61·44 copper and 38·15 zinc. It is very probable that malleable brass will hereafter, in many cases, be made use of instead of the higher-priced copper.—*Verhandlungen des Vereins zur beförderung des Gewerbfleisses in Preussen*, 1849.

MESSRS. LAURIE AND MARNER'S REGISTERED INVISIBLE CARRIAGE STEP.

Fig. 1.

Fig. 2.

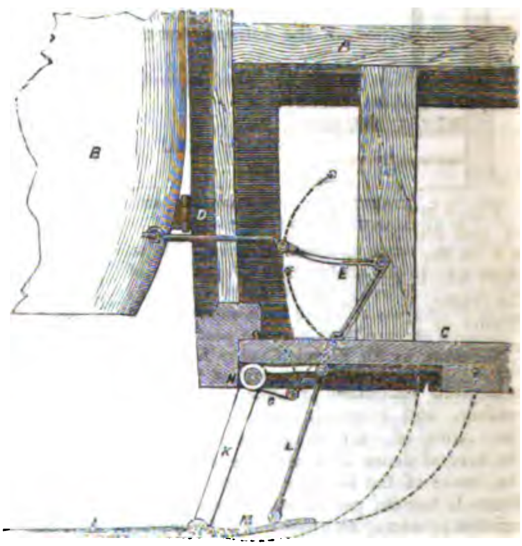


Fig. 1 is a cross section of so much of a carriage as is necessary to show the means by which that great desideratum —*an invisible carriage step*—has been accomplished; that is to say, a step which only comes into sight and place when wanted, and retires out of sight the moment the carriage-door is closed. A plan of the step is given separately in fig. 2. A is the rail of the carriage seat, B the door, and C the floor of the carriage. The door is represented as being open, in which case the step is in the proper position for entering the carriage. When the door is closed it causes the rod D to be pressed inward, and the bell crank E to move in the direction indicated by the dotted lines, upon which the bell crank again, through the intervention of the connecting rod F, pulls up

the lever arm G, which is affixed to the spindle H; and by causing that spindle to make a partial revolution, brings up the step I and the arms K, by which it is suspended close to the floor of the carriage. L is a guide rod, which is jointed to a tail M formed on the back of the step, and makes the step to fold close up against the floor. When the door is opened, the step is thereby brought into the position represented in the engraving.

PARKER'S REGISTERED KNIFE AND FORK CLEANER.

Fig. 1. Fig 2.

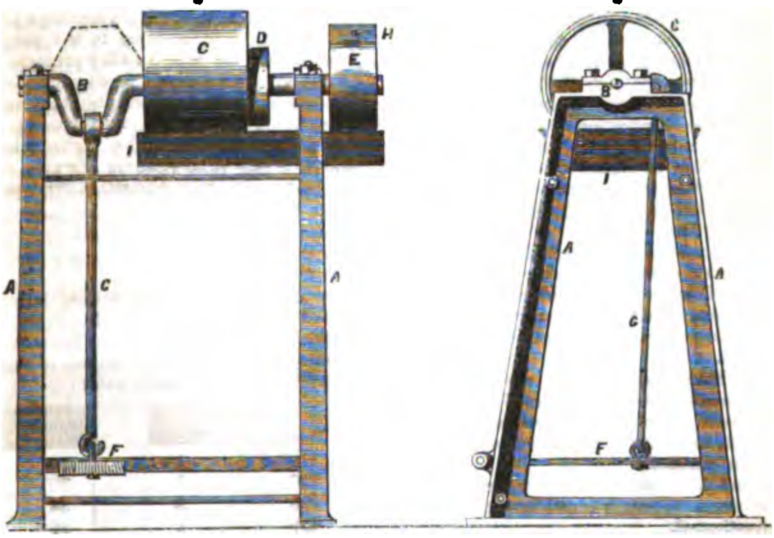


Fig. 1 is a front elevation; and fig. 2 an end elevation of this knife cleaner. AA is the framework; BB a cranked shaft which has its bearings in the top of the frame, and has fitted upon it three drums or pulleys C, D, and E. F is a treadle connected with the crank on the shaft B by a rod G. The first drum C is covered with one or more plies of buff leather, and is employed for cleaning the sides of the blades of knives; the second drum D is used for cleaning the backs of the blades; and the third drum E has its periphery covered with bristles or wires, and forms a cylindrical brush, suitable for the cleaning of forks. In cleaning the forks, they are introduced through a hole *a* in the covering H of the circular brush. I is a trough for holding emery or brickdust.

This instrument possesses several obvious advantages over the patent one which has recently come so much into vogue. First, it serves to clean both knives and forks, whereas the patent one cleans knives only; second, it is much less liable to get out of order; and third, it may be made (we fancy) at one-half the price.

MR. FROST'S DISCOVERIES IN STEAM.—(SEE ANTE VOL. LII., P. 191, ALSO DR. HAYCRAFT'S PAPER, P. 288.)

Report of the Committee of Arts and Sciences of the American Institute of New York, on Mr. Frost's Pamphlet. With Notes by Mr. Frost.

After perusing the said pamphlet, several members of the Committee proceeded to the residence of Mr. Frost, at Brooklyn, where they carefully examined all the apparatus devised by Mr. Frost for the illustration of his theory, witnessed a number of the experiments which he performs by means of them, and assisted at the trial of an engine propelled alternately by steam generated in the usual manner, and steam heated after being generated, out of contact with water.

In respect to the apparatus they report

that it is planned with much ingenuity, and upon principles which admit of no doubt as to the accuracy of the results exhibited by experiments performed with it. These results will be hereinafter spoken of in detail. In respect to the engine they found a very marked and decided superiority in the measure of the work performed by it, when the steam was heated after being generated. In the absense of those members of the Committee practically skilled in the action of steam engines, however, they do not venture to assert that the principles upon which the engine acts when propelled by steam heated after being generated is certainly capable of convenient application to the steam engine. Enough however was obvious to them to enable them to report that the principle is in itself true, and that the application of it to practical use is well worthy of careful investigation.

The experiments described by Mr. Frost, of which a sufficient number were witnessed by the Committee to enable them to assert that there is no reason to suspect any fallacy in their results, may be divided into two classes.

1. Those by which the expansive force and tension of steam, heated after being generated, to which, in the remainder of this report, the name of dry steam will be given, are determined:

And 2. Those by which the relations of dry steam to sensible and latent heat, are investigated.

In relation to the experiments of the first class, it is proper to premise, that previous to the publication of the experiments of Mr. Frost, it was held, and admitted by all scientific men, that the vapour of water and of all other bodies did, like atmospheric air, obey the law known by the name of the experimenter who first investigated it, Guy Lussac; and did, in conformity with that law, expand $\frac{1}{480}$th part of their volume at the temperature of freezing water, for every increase of 1° of Fahrenheit, in their temperature. The accuracy of this law, after being received universally for near half a century, has recently been called in question, even in its application to the gases; the experiments under consideration seem to show that it is very far from being true in dry steam. Guy Lussac appears to have been too hasty in admitting the universal application of his law; and even in the cases whence he derived the inference that it was true of the vapour of water, his experiments, as far as your Committee have been able to ascertain, did not extend to the particular points which have been the chief subject of Mr. Frost's investigations. The published results of Guy Lussac, derived from his experiments on the vapour of water, extend from 32° Fah. to 212° F., and therefore cease exactly where Mr. Frost's begin. There is, therefore, in reality no received law to be set aside. That of Guy Lussac remains unchanged, although restricted by the limits of the experiments on which it is founded; and any other law determined by experiments beyond these limits, is not in opposition to, but an extension of, his law. It has been considered important that these facts should be stated, inasmuch as the investigations of Mr. Frost might be rejected without examination, as contrary to a well-established law of nature, were it not clearly shown that this law has been too far generalized.

By means of various apparatus, fully described in his pamphlet, Mr. Frost has obtained the following relations between the volume, temperatures and tensions of steam, heated out of contact with water:

Temp.	Volume,	Tension in inches of Mercury.
212°	1	30
216	2	32
228	3	34
450	4	36
600	6	40
650	7·37	42·75

Whence it may be inferred that the volumes under the pressure of a single atmosphere, and the tension under a constant volume, would have borne the following relations to the temperature:

Temp.	Volume under pressure of 1 Atmosphere.	Tension under a given volume.
212°	1	30 inches
216	2·133	64 ,,
228	3·4	102 ,,
450	4·8	144 ,,
600	7·2	216 ,,
650	9·8	294 ,,

The experiments of Mr. Frost have furnished, in his opinion, complete proofs of the truth of the law of Mariotte, by means of which the relations in the last Table have been calculated.

Mr. Frost next proceeded to measure the actual quantities of heat contained in steam generated from water boiling under different pressures, and in steam generated at the

(1.) The use of the term dry steam for this wonderfully and more valuable and distinct element (Stame) is not only peurile but undistinguishing—for Count Rumford showed that all steam was dry (fifty years ago) thrusting a long-used cane into common steam—in a few minutes the wood shrunk so much the ferrule fell off.

(2.) A droll affair this to term an enormous mistake, an established law of nature.

temperature of 212°, and heated afterwards out of contact with water. In the first of the two cases, he reaches the conclusion, that "*Natural Steam, however varying in density or temperature, is one invariable atomic compound of water and caloric, and as definite as any chemical atomic compound whatsoever.*" This, when translated into more familiar language, is no more than the well-known law which has long been received as approximately, but not exactly true; namely that, *The sum of the latent and sensible heat in the vapour of water, whatever be its temperature or density, is a constant quantity.*

Mr. Frost's experiments do not appear to furnish better grounds for considering this law as more than approximately true, than those of others; and to receive it as more than an approximation, is attended with difficulties which have so often been pointed out, that it is unnecessary to state them in this report. Upon this law, however, Mr. Frost founds an argument against the profitable application of high steam, on which head it is sufficient to state that on this very law is founded the reason why high steam can be employed with advantage; because the tension due to its increased temperature is obtained without cost.

In respect to steam generated at 212°. and subsequently heated out of contact with water, Mr. Frost infers that the increased tension which has been exhibited in the Tables above set forth, is obtained by the addition of comparatively small quantities of heat. Thus to raise the dry steam from a temperature of 212° to 650° and give it a tension of 9·8 atmospheres, requires no more heat than is to that which is required to raise water from a temperature of 50° and convert it into steam of the tension of one atmosphere, as 38 : 32. Upon this Mr. Frost founds a theory, that steam heated out of contact with water, becomes a new atomic combination "of water and caloric." We do not see that it is necessary to resort to this hypothetical mode of expression, nor is there any experimental evidence of a change in the relations of the aqueous matter to latent heat. All that occurs can be explained in language more familiar, and which, although also hypothetic, is so universally received that it may be used with as little risk of being misunderstood, as if truly expressed facts. In this language the amount of the discovery of Mr. Frost may be stated, by saying that steam heated out of contact with water has a very low capacity for specific heat. Following out his own hypothetical views, Mr. Frost chooses to call his supposed new combination of aqueous matter and "caloric" by the name of *Stame.* Your Committee are not of opinion that the use of such new name is of absolute necessity, and have therefore avoided its employment, particularly as the epithet *dry*, if applied to steam not in contact with water, is fully and sufficiently expressive of every thing that is positively known, or which requires to be expressed in language by way of distinction between steam heated out of contact with water, and steam in contact with the water whence it has been generated.

In expressing a difference of opinion from Mr. Frost, in relation to the law of the constancy of the quantity of heat in ordinary steam, and in respect to the necessity of a new name for dry steam, your committee do not intend to detract in the least from his high merit, nor from the value of the deductions he has made from his experiments. These deductions are of great value as additions to the theory of elastic fluids, and afford an explanation of facts and occurrences which no previous theory has reached. We have seen that an increase of the temperature of dry steam from 212° to 650°, or little more than 400° increases its elastic force nearly ten fold, and that this increase of force can be attained by an expenditure of heat not greater than one-fourth of that by which the steam was originally generated. Can it be doubted that in this simple, but hitherto unknown fact, lies the cause of by far the greater part of the explosions of steam boilers. It is conceded by almost all who are competent to examine the subject, that the dangers which might otherwise accompany the use of steam generated in a boiler no part of whose surface is hotter than the water it contains, can be prevented by the use of the common safety-valve, and the very weakness of parts of a boiler may prove a source of safety. On the other hand it is almost always possible to infer that there

(3.) The discovery claimed, is not that steam is a definite compound of water and heat—but the great and necessary deduction from that postulate—namely, that a trivial addition of heat to steam, out of contact with water, constitutes it a distinct elementary compound of the same atoms, of enormously augmented volume and value.

(4.) If the professor cannot understand so plain a fact, perhaps he will be able to understand the following proof thereof.—The late substitution of a Low Pressure Condensing Engine (at the Novelty Works, New York,) for a High Pressure Non-condensing Engine, has reduced the daily consumption of coals from six tons to less than two and-a-half tons. How pitiful, then, was the previous high-pressure engine in such great use. Yet how much more pitiful is the polished engine, selected for driving the machinery at the Great Fair of the American Institute, though of splendid workmanship, and furnished with that rare appendage, a steam jacket, but into which the exhausted steam is passed for the immeasurable ignorant attempt to heat the cylinder with colder steam, the most rapid abstractor of heat in nature.

have been causes capable of heating some portion of the boiler to temperatures far above those of the water it contained, previous to all positive explosions. Now if an additional heat of 400° suffices to increase the elastic force of dry steam nearly ten-fold, how great might the increase of elastic force become, if the steam were in contact with incandescent metal, and heated from 1600° to 2000° above its normal temperature

The low capacity for heat which has been found by Mr. Frost in dry steam, accounts for the fact that explosions arising from the cause we have referred to, are often preceded by a diminution in the force with which the engine works. It also enables us to explain how it happened that although the very action proposed by Mr. Frost, namely, the heating of dry steam, has been employed for many years in the "Steam Chimneys" so familiarly known, no very important advantages have been gained by their use. In this case the steam has parted with its temperature to the cylinder and steam passages just as rapidly as it has acquired it.

In this cause also we are to find the reason of the difficulties which Mr. Frost has experienced in applying the principles deduced by his experiments to the actual working of an engine. These difficulties he has overcome in an engine of small size, by methods extremely ingenious and sufficiently simple.

It should be considered that we know that incandescent metal may drive off water in globules, and that this incandescence is often produced in particular spots of the boiler, by means of an accidental high heat produced by peculiar arrangements of fuel and draught of air, and particularly where there is not enough of water in the boiler. In such cases an explosion may be the consequence.

It should also be considered that more of the metals than is usually admitted are capable of decomposing steam when intensely heated, and are thus oxidated. These considerations show that there must be difficulties or even dangers in the use of dry steam, and ought to be taken into account in any attempt to reduce Mr. Frost's principles to practical application.

James Renwick,
H. Meigs,
Henry R. Dunham.

Committee.

American Institute, Sept. 2, 1850.

(5.) If the Professor foresees difficulties in imagination, I have found none in practice, that any educated practical engineer could not avoid or surmount.

Supplementary Investigation by Mr. Frost.

A learned and liberal professor (Renwick), who has long devoted particular attention to the subject of steam, has been attempting an apology for the astounding errors of Gay Lussac and Dr. Dalton, by stating their experiments having been made on steam of less temperature than 212°, were established laws of nature; while all mine having been made on steam of greater temperature than 212°, though true, were from that cause incomparable with those writers' experiments, and, therefore, there was no difference between us.

Very unhappily for those established laws, and for this most learned and laboured apology—but more happily for science and the general welfare of mankind—they have led me to investigate the combination of greater heat with steam *below the temperature of* 212°, because it has disclosed the greater discovery, that a volume of steam below 212°, heated apart from water, is proportionally far more expanded by extra heat than is steam above 212° expanded by extra heat as detailed in my Pamphlet; and these newer facts will become unquestionable to any competent judge perusing the following detail of instruments and means pursued for eliciting the truth.

Figs. 1, 2, 3, are drawn to a scale of one-tenth the original.

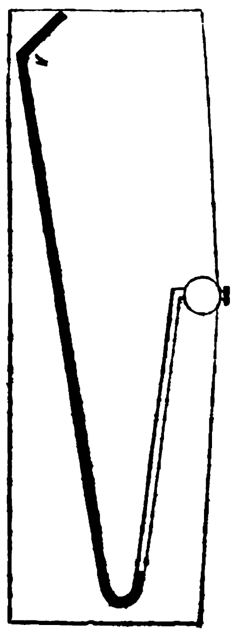


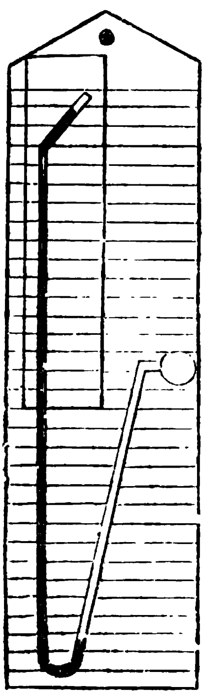
Fig. 1.

Fig. 1, represents a glass barometer tube, into the short sealed end A, 3 inches in length, a small drop of water was introduced through an aperture in the bulb—and that and A, and all that part of tube of a dark colour, filled with mercury; the tube being attached to a board, was immersed horizontally to the lower part of bulb, within a saturated solution of salt in a boiler.

The solution of salt being very gradually caused to boil, and continued at that heat for an hour, converted the inclosed water to steam of temperature 228°, which, sufficiently confined, would have acquired a tension of upwards of 41 inches mercury, but being confined by only 36 inches, all the steam escaped from the tube except the portion retained in A; and as may be seen in my former Pamphlet, steam so heated and rarified under such inadequate pressure within a eudiometer, contains or retains only sufficient basic water for the reproduction of one-third of its volume of steam of temperature 212°, and tension 30 inches of mercury.

By this oft tried and easy means, was separated and secured for future experiment within the barometer, the equivalent of basic water for a unit inch of atmospheric steam.

Fig. 2.



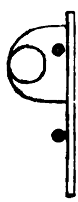


Fig. 3.

TABLE *of the Temperature, Volume, Elastic Force, and Actual Volumes of an Inch of Steam, Tension 30 Inches Mercury, generated and confined within a Barometer, heated therein apart from Water, expressed in Inches Mercury.*

Temperature.	Volumes in Inches Mercury.	Tension in Inches Mercury.	Actual Volumes.
212°	10	20	200
180°	9	18	162
172°	8	16	128
165°	7	14	98
159°	6	12	72
150°	5	10	50
138°	4	8	32
128°	3	6	18
115°	2	4	8
94°	1	2	2
31°	0·1	0·2	0·01

Fig. 2, represents this prepared steam barometer attached to a board, in which horizontal lines have been previously drawn an inch asunder—the tube then being temporarily so inclined, that the mercury filled the upper part, till the quantity of mercury was so adjusted in the tube, that the upper and lower surfaces were exactly 30 inches asunder, then when the tube was suspended perpendicularly, the mercury was depressed at the upper part and elevated at the lower part, proportioned to the heat to which the vapour in A was subjected.

In fig. 2, at temperature 94, the depression above, and elevation below, were each equal to an inch, therefore the tension of vapour in barometer counteracts the atmospheric pressure of 30 inches, just 2 inches, and reduces the mercurial column to 28 inches, showing that the volume of steam at that temperature has an equal magnitude, but only one-fifteenth part the tension of the atmospheric steam from which it has been reproduced.

The accompanying Table shows the volume and tension of that vapour at every inch, and corresponding temperature from zero to 212°, and a careful perusal thereof will afford great and greatly-needed insight to the great difference of actual volumes and great loss of efficiency of engines, occasioned by very small difference of temperature; a most important matter, at present little known, or disregarded.

For according to Marriott's law the actual volumes are as the multiples of tension and volume; therefore if the original volume of steam (1) is multiplied by its tension, its actual volume may be termed 30; then as the volume and tension have been each increased tenfold at 212°, the actual volumes have been as

$$10 \times 20 = \frac{200}{34} = 6{\cdot}66$$

times by heating a volume of steam apart from water under diminished tension, and below 212°; therefore the proportionate expansion of steam by extra heat is thus shown to be twice as great below 212° as at higher rates quoted in Pamphlet and Appendix, and therefore the employment of steam produced at low pressure will be eventually found, not only more convenient and safer, but far more economical and powerful than has yet been anticipated.

To make these experiments, the upper part of barometer was inclosed within a boiler of bright exterior surface—the form and place thereof shown by strong lines on fig. 2 and section 3.

The experiment commenced by placing within the boiler a tin tube shown in section 3, then by nearly filling the remaining space in boiler with hot water, and placing a hot iron rod in tin tube, the water was caused to boil, the vapour in barometer to expand, and force the mercury to descend in the upper part and to ascend in the lower part, where it could be plainly seen.

As the boiler required several hours to cool, ample opportunity was afforded for recording the descent of the mercury at every inch, and of a thermometer placed in boiler, the Table fig. 4 was easily and correctly constructed.

The great economy that will result from the conversion of steam to "stame," and its costliness for motive force, cannot but be apparent to any competent and candid judge.

Further Experiments.

This is to certify that we, the undersigned, met together, and witnessed the following experiments:—

First, an engine working under ordinary circumstances, with a pressure of 21 lbs. on boiler, engine made 2000 revolutions; the steam passing through a surface condenser in a cistern, heated the water therein from 48° to 62°, and engine exhausted the steam on boiler.

Under the second experiment, by heating the steam apart from water, the engine ran 2000 revolutions, and the steam condensing in the surface condenser heated the water in cistern from 61° to 70°, and the pressure of steam on boiler increased from 21 lbs. to 37 lbs.

T. H. Secor, Secor Iron Works, New York.

Alex. H. Stevens, Principal, New York University.

W. Caldwell, Engineer, Steamers *America* and *Asia*.

Edmund Tuthil, Engineer, Secor Iron Works.

John Leitch, Captain, Steamer *America*.

James How, Union White Lead Works, Brooklyn.

Wm. Arthur, Vulcan Steam Works, Brooklyn.

The condenser fitted with mercurial gauge showed a steady vacuum of 12 lbs., therefore the effective steam power being 12 lbs. in first experiment, and 12 + 37 = 49 lbs. in second experiment, while 14° of heat was expended in first, and only 9° of heat in second.

Then, as

$$12 : 49 :: 1 : 4{\cdot}1 \times \frac{14}{9} = \frac{57{\cdot}4}{9} = 6{\cdot}36$$

times the effective force derived from an equivalent of caloric from heated steam (or stame) than was derived therefrom when applied to steam.

Similar experiments with the same engine, apparatus, and results, have been witnessed by numerous and equally competent engineers and other scientific persons.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING NOVEMBER 14, 1850.

JOHN TATHAM and DAVID CHEETHAM, of Rochdale, Lancaster, machine makers. *For certain improvements in machinery or apparatus and operations connected with the manufacture of cotton, wool, silk, and other fibrous substances and fabrics, and in the application of certain materials to the manufacture of textile fabrics.* Patent dated May 7, 1850.

The improvements of the present patentees, which are respectively described and claimed in the specification, are

1. Casting the axes of cylinders, doffers, fancies, or other rollers on which wire cards are to be set in the same pieces with the cylindrical portions thereof, or with one or both ends only.

2. The application of two or more suitable feeding apparatuses to one beater in scutching or lap machines.

3. Transferring the slivers (with or without twist) on to bobbins from cans or other receptacles in which they have been deposited by the carding engine frame, or by any machine used previously to the bobbin and flier frame, such transferrence being effected by means of revolving rollers acting on the peripheries of the bobbins or of fliers revolving around them.

4. With regard to the bobbins of slubbing and roving machines which revolve by traction (according to the method patented by Messrs. W. Eccles and Co., Dec. 3, 1849), connecting the whole, or a portion of them, together, by means of toothed gear straps, bands, or other suitable arrangement.

5. The application of an arresting apparatus to slubbing and roving machines, for the purpose of stopping their motion upon the absence or breakage of a slubbing or roving; such apparatus being placed between the delivering roller and the flier or spindle.

6. The application of a brake to slubbing and roving machines, to carding engines and to swifts or reels, for the purpose above set forth.

7. Making the spindles to be used in slubbing and roving machines hollow.

8. Constructing the presser in connection with the flier in such manner that the cotton or other fibrous material may be pressed between two surfaces. Also, providing the presser with two or more eyes, through which the cotton or other material is to be threaded. The principle of this improvement being that the attachments may be made within the staple of the material, or within that space in which it may be held without risk of breakage.

9. The employment of friction surfaces in combination with toothed wheels, for the purpose of giving motion to any desired part or parts of machines used in the manufacture of cotton or other fibrous material or fabric.

10. Forming the cog wheels, or the cogs only of cog wheels used in such manufactures, of gutta percha or its compounds.

11. Forming the caps or covers of the feet of spindles used in such manufactures of gutta percha or its compounds.

12. The employment of suitable apparatus, worked by the agency of exhausted or compressed air, for the purpose of imparting motion to the looms separately or to the sleys of looms.

13. Imparting rotary motion to the warp beam of looms, through the intervention of a roller revolving in contact with the work beam, for the purpose of letting off the yarns as soon as the woven fabrics are produced.

14. The employment of the material known as "spun silk" as the warp threads in the manufacture of "hat plush" and velvet, such material being used either alone or in combination with a certain proportion of raw silk.

JOSEPH GIBBS, C.E. *For improvements in artificial stone, mortar, and cements, and in the modes of manufacturing the same.* Patent dated May 7, 1850,

Claims.—1. The manufacture of mortar and cement from chalk marls, the calcareous marlstones of the Ashburnham beds, the calcareous shales of the Purbeck formation, the rummel beds of the lias formation, the calcareous and mountain limestone shales, bastard limestone and the "metals," and pyritous septaria of the coal formation, all or any of them, when prepared for the purpose by grinding or pounding, and by treating with water as described, and whether the same are combined or not combined with certain hardening materials (afterwards specified) or other cementitious substances.

2. The use of the "hardening materials" described, when used in combination with any of the calcareous substances enumerated in the preceding claim, or in combination with any other natural calcareous marl or marlstones.

3. The use of the calcined Folkstone pyritous earth, the sparry ironstone or white ironstone of the mountain limestone, and the calcined pyritous septaria of the coal measures, as "hardening materials" in combination with any artificially-formed cement composed of chalk, or lime and clay, ground

and calcined in the manner now usually practised for manufacturing artificial cements.

4. The mixture of any of the before-described marls or marlstones, or pyritous septaria from the coal measures, with each other, or with any of the water cements or limes now in use, or the materials of which the same are composed.

5. A particular process of pounding and grinding cement and materials mixed therewith, as described.

6. The consolidation of cement and materials mixed with such cement by concussion, as described, for forming blocks or other solid shapes in moulds.

7. A process of making artificial stone by putting plastic materials between lattices or other convenient forms; and also certain methods of casting hollow parellelograms in cement, to be afterwards filled up with concrete, for walls of artificial stone.

8. The use of a kiln with fire vaults under the whole area of such kiln, such vaults communicating with each other in various directions through spaces between the bricks composing such vaults.

9. The use of a brick with projections for constructing fire vaults, as described, for calcining marls, marlstones, cements, and other materials used for making hydraulic mortars.

10. The use of a circular or continuous kiln, as described, for the purpose of making mortars and cements.

George Robbins, of Forrest Lodge, Southampton, gentleman. *For improvements in the construction of railway carriages.* Patent dated May 7, 1850.

These improvements do not properly relate to "the construction of railway carriages," but to brakes of a peculiar description, by which such carriages may be acted on to any required extent, at the will of the brakesman. [According to several decided cases, this is a discrepancy fatal to the patent.] The carriages to which the improvements are to be applied are supported on the wheels in the usual manner, and furnished with buffers and draw bars of the ordinary kind. The inner ends of the draw rods are respectively furnished with straps, each of which embraces and supports a buffer spring composed of two parts, the additional part being employed for the sake of obtaining greater power of resistance. The ends of the buffer spring bear against shoes formed on the buffer rods, and near the periphery of the driving wheels a brake is suspended from the framing by a moveable joint and pin. The buffer rods have attached to them springs which act against these brakes when the buffers are shoved home, and produce an elastic pressure against all the wheels. Near the centre of the framing are fixed two tumbling or stop pieces, which have attached to the under side of their lighter ends arms, which sustain friction rollers; similar arms are also fixed to the framing, but carry two rollers each, between which and over the before mentioned roller is passed a chain connected at each end to the link piece of the swivel attachment of the carriage. When this chain is tightened the tumbling pieces are brought into a horizontal position, and if the carriage be now reversed, the brakes will not be brought into action, and the tumbling pieces afford sufficient resistance to allow of the carriage being shunted in the reverse direction, but when the carriage proceeds onwards, the chain is slackened and the brakes are ready for action.

The apparatus for taking up the slack of the chain, and which may be attached to either the tender or the guard's carriage, is thus described:—Mounted in guides in the framing of the tender, are two sliding rods connected by a strong helical spring, and for each of the rods a catch piece is provided to regulate the distance of their traverse. To the outer end of one of the bars is attached a swivel, which is secured to the chain of the link piece of the adjoining carriage; and to the opposite extremity of the bar to that which is secured by the helical spring is attached a common carriage spring, the ends of which slide over friction plates bolted to the framing of the carriage, and to the opposite side of the spring is connected a chain. This chain is secured at its other end to a segmental piece keyed on a cross shaft supported by the framing of the carriage, upon which shaft is mounted a bevel wheel gearing into a similar wheel on a vertical shaft, to the upper end of which is affixed the winch handle by which the whole mechanism is actuated.

The patentee describes also several other modifications of both of these contrivances, in one of which the buffer rods are brought into direct contact with the tumbling pieces.

Claim.—The means described by which self-acting brakes are brought directly under the control of the brakesman.

John Youil, of Ardwich, Manchester, brewer. *For certain improvements in machinery or apparatus for washing, cleansing, filling, and corking bottles and other vessels.* Patent dated May 8, 1850.

With regard to the "apparatus for washing and cleansing," the patentee disclaims the sole use of revolving brushes, but claims—

1. A method of combining an internal with an external brush, so that they may, whilst revolving, operate simultaneously on the respective parts of the bottle or vessel to be cleansed, [which is supported in an inverted position in a funnel-shaped tin

casing placed over a cistern of water supplied by pumps, or from any convenient source at a sufficient height above the cistern to give the requisite rise to the water.]

2. A method of constructing the internal brush with a hollow spindle, so as to inject water into the interior of the bottle—also with the top bristle composed of metallic wire or other durable material, and a mode of securing the same to the spindle by a band of gutta percha or soft metal placed around the bristles, and between them and the orifice at the end of the tube—also a method of attaching the side bristles to the spindle by means of dovetailed wedges so placed as not to obstruct water in its passage through the spindle.

3. A mode of constructing the external brush with tubes interposed between the parts thereof in such manner as to eject water against the exterior of the bottle; and also the use of sponge in connection with such brushes.

4. The combination of a brush for cleansing outside the bottom of the bottle, with a brush for striking off labels—the latter being composed of metallic wire, or of wire and hair bristles intermixed [this compound brush being placed either above the cistern or revolving therein]; a method of giving a rolling motion to the bottles, and of holding them securely by springs whilst undergoing the operation of cleansing by means of the combination of brushes described. [For which purpose a crosshead with three arms is employed, one of which is slotted at one end where it is attached by a pin to the framing, the other end being connected to a crank, which revolves and causes the two other arms to work elliptically; which motion they impart to the bottles.]

Under that head of the specification relating to the "filling" process the patentee claims—the application of a slide (worked by a rack and pinion, and capable, when raised, of being brought up close by means of set screws) to the front part of similar and equal cells so as to cause them to assume the same capacity, and to contain any required quantity of liquid; also a method of stopping the supply of liquid to the cells by means of the overflow from themselves falling into a vessel supported by a framework at one end of a lever, to which is connected at its opposite extremity the rod of the piston-valve for admitting the fluid into the cells; and also a mode of discharging the contents of the cells in any number simultaneously into bottles placed underneath, by means of a series of valves, one in each cell, connected to a rod, which when raised by a hand lever permits the liquid to escape.

Lastly; with reference to the "corking" operation, Mr. Youil observes that he makes no claim to the employment of a sliding ram for this purpose, inasmuch as this has been already previously used, but that he claims the employment of a funnel or hopper filled with corks thrown in at random and continually subjected by the intervention of cams to a rapid concussive action, for the purpose of keeping a tube in connection with it constantly supplied with corks.

Finally; the patentee claims the general and particular arrangement of the parts constituting the said improved machinery for washing, cleansing, filling, and corking bottles, without restriction or limitation to the precise details given, provided the peculiar characteristic features of the invention are retained.

GEORGE HURWOOD, of Ipswich, Suffolk, engineer. *For improvements in grinding corn and other substances.* Patent dated May 7, 1850.

Claims.—1. A mode of preparing the parts or bodies of metal mills to fit them to receive the cutting or grinding parts, so that when required such parts may be readily removed and replaced.

2. The making the cutting parts in a series of plates or rings, to be put together when used either for plans, cones, or other figures.

3. The forming of the teeth of the cutting parts by stamping or pressing the metal when hot upon dies.

4. The making the plates or rings forming the cutting parts by casting iron upon chills.

5. The making the cutting parts in one piece, with a series of teeth, each so radiated and divided as to present a similar face to that presented by putting together a series of separate rings, either by casting iron upon chills or stamping iron upon dies.

6. The making of the case and plates with a ball and socket joint, and adjusting screws for metal mills.

7. The application of fans to be fixed upon the revolving parts within the case of metal mills.

8. The causing of currents of air to pass the grinding surfaces of metal mills either by exhaustion or pressure.

9. The introduction of air between the grinding surfaces of millstones by apertures made at an angle to the face of the stone from within the eyehole of the runner stone.

10. The introduction of air between the grinding surfaces of millstones from the bedstone, by making the neck-box hollow to admit of the air being forced through it, and fixing conducting pipes to the same to convey the air to the place required.

11. The introduction of air between the grinding surfaces of millstones by apertures made at an angle to the face of the stone from within the eyehole of the bedstone.

Thomas Main, of the Strand, printer, for improvements in printing machinery. November 8; six months.

James Rock, jun., of Hastings, Sussex, coachbuilder, for certain improvements in carriages, which are also applicable, in whole or in part, to other machinery. November 9; six months.

William Palmer, of Sutton-street, Clerkenwell, manufacturer, for improvements in the manufacture of candles and night lights. Nov. 9; six months.

James Scott, of Falkirk, N. B., shipwright, for certain improvements in docks, slips, and apparatus connected therewith. November 9; six months.

Sir Francis Charles Knowles, of Lovell, Bucks, Bart., for improvements in the manufacture of charcoal. November 9; six months.

Lucien Vidie, of 14, Rue du Grand Chantier, Paris, France, French advocate, for improvements in measuring the pressure of air, steam, gas, and liquids. November 9; six months.

Joseph Nye, of Mill Pond Wharf, Old Kent-road, engineer, for improvements in hydraulic machinery, parts of which improvements are applicable to steam engines and machinery for driving piles. November 12; six months.

George Robins Booth, of London, engineer, for improvements in the manufacture of gas. November 12; six months.

Peter Spence, of Pendleton, Manchester, manufacturing chemist, for improvements in the manufacture of alum and certain alkaline salts, and in the manufacture of cement, part of which improvements are applicable in obtaining volatile liquids. November 12; six months.

Edwin Clark, of Palace New-road, Middlesex, civil engineer, and Henry Mapple, of Child's Hill, Hampstead, for improvements in electric telegraphs, and in apparatus connected therewith. November 12; six months.

Henry Medhurst, engineer, in the employ of Messrs. Shears and Sons, of Bankside, Southwark, for improvements in gas meters. November 12; six months.

Etienne Masson, of Place St. Michael, Paris, gardener, for improvements in the preparation of certain vegetable alimentary substances for the provisioning of ships and armies, and other purposes where the said substances are required to be preserved. November 12; six months.

John Ball, of Ashford, Kent, engineer, for improvements in applying heat to bakers' ovens and their appendages. November 12; six months.

Henry Wimshurst, of Limehouse, Middlesex, shipbuilder, for improvements in steam engines, in propelling, and in the construction of ships and vessels. November 12; six months.

Charles Marsden, of Kingsland-road, Middlesex, engineer, for improvements in scissors and thimbles. November 12; six months.

William Duckworth, of Liverpool, coffee merchant, for certain improvements in the manufacture of chicory, with certain improvements in the machinery or apparatus for the manufacture thereof. November 14; six months.

Thomas Shore, of Exwich, Devon, miller, for an improved method of dressing flour. November 14; six months.

Robert Howarth, of 61, Chapman-street, Oldham-road, Manchester, for improvements in machinery for raising a nap on cotton, woollen, silk, and other fabrics. November 14; six months.

Abraham Haley, of Frome, Somerset, machinist, for certain improvements in looms for weaving. November 14; six months.

Edward David Ashe, of Brompton, Middlesex, Lieutenant in Her Majesty's Navy, for a new or improved nautical instrument or instruments applicable especially amongst other purposes to those of great circle sailing. November 14; six months.

John Swindells, of the firm of Swindells and Williams, of Manchester, and Juce, near Wigan, manufacturing chemist, for certain improvements in obtaining products from ores and other matters containing metals, and in the preparation and application of several such products, for the purpose of bleaching, printing, dyeing, and colour making. November 14; six months.

Joseph Conrad Baron Liebhaber, of Paris, France, for improvements in blasting rocks; also in working marble and stone, and in preparing products therefrom. November 14; six months.

Charles Allemand, of Paris, France, gentleman, for an improved apparatus for producing light. November 14; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Nov. 7	2523	John Verrinder	Lincoln	Box table and sofa-bedstead.
,,	2524	Jenkins and Ashford	Birmingham	Mattress.
,,	2525	James Tonkin	Oxford-street	Improved spring lath.
,,	2526	William Wilson	King-street, Manchester	Hot-water cistern for baths, &c.
8	2527	Thomas Moore Sharp	Belfast	Improved paddle-wheel.
,,	2528	George Horton	Thomas-street, Manchester	Joiners' brace.
9	2529	George Broughall	Willenhall, Stafford, Key Stamper	Improved steam stamp.
11	2530	C. and J. Clark	Street, near Glastonbury, Somerset	Parts of shoes.
12	2531	Fowler and Fry	Temple-gate Factory, Bristol.	Improved cart.

CONTENTS OF THIS NUMBER.

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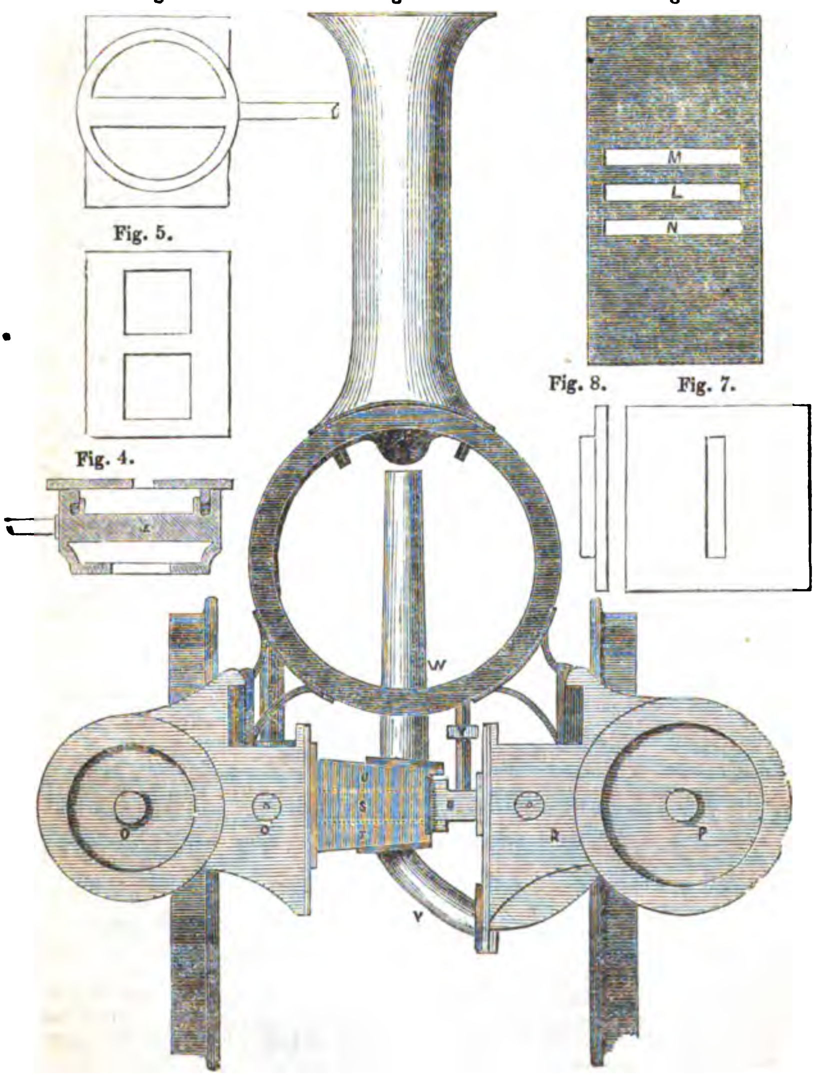
No. 1424.] SATURDAY, NOVEMBER 23, 1850. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

MR. SAMUEL'S CONTINUOUS EXPANSION STEAM ENGINE.

Fig. 6. Fig. 2. Fig. 3.



MR. SAMUEL'S CONTINUOUS EXPANSION STEAM ENGINE.—(*See ante p.* 299.)

Specification.

My improvements in the construction of steam engines have for their object the economising of steam and fuel. For this purpose I construct my improved steam engines with their cranks placed at right angles with each other, or nearly so, and with two or more cylinders, and I cause a portion of the steam admitted into the first cylinder to pass into the second; and if more than two cylinders be used, I cause the steam to pass to each of the cylinders in succession for the purpose of giving motion to their pistons respectively.

And in working an engine constructed according to this part of my invention, after the supply of steam admitted from the boiler into either end of the first cylinder for producing one stroke of the piston has been cut off (which I prefer to do about the middle of the stroke) I open a communication between that end of the first cylinder and the end of the second cylinder, from which the piston thereof is to be impelled; and the expansive force of the steam will thus be made not only to continue the motion given to the piston of the first cylinder for the residue of its stroke, but also to give motion to the piston of the second cylinder in the required direction.

The communication between the two cylinders being then cut off, the expansive force of the steam which has been admitted into the second cylinder will complete the stroke of the piston of that cylinder; after which this steam may be admitted into a condenser, or into the chimney of the engine for producing a blast, or the steam, or a portion of it, may be conducted from the second cylinder to a third cylinder, for the purpose of giving motion to a piston in like manner as the steam has been conducted from the first cylinder to the second.

The stroke of the piston in the first cylinder occasioned by the admission of steam from the boiler into one end of that cylinder, as already mentioned, having been completed, I open a communication between the boiler and the opposite end of the first cylinder, so as to admit steam and produce a stroke or motion of the piston of that cylinder, in a direction contrary to that already mentioned, and I cut off the supply of steam from the boiler in like manner as before; I then open a communication between the last-mentioned end of the first cylinder and that end of the second cylinder, from which its piston is now to be moved, and the expansive force of the steam will then not only continue the motion given to the piston of the first cylinder for the residue of the stroke, but also give motion to the piston of the second cylinder in the required direction. This second communication between the two cylinders being then cut off, the expansive force of the steam contained in the second cylinder will complete the stroke of its piston: after which the steam may be admitted into a condenser, or otherwise disposed of, as already mentioned. These motions may of course be repeated and continued as long as the engine may be required to work.

By this mode of passing or regulating the passage of steam from one cylinder to another, the whole, or nearly the whole of the expansive force of the steam acting against each of the pistons is exerted in the directions in which the pistons are respectively intended to move.

In figs. 1 and 2 I have shown a mode of applying this part of my invention in the construction of a railway locomotive engine.

Fig. 1 is a horizontal cross section of parts of such a locomotive engine, showing the application of my improvements thereto, the section being shown as taken through the centres of the two cylinders.

Fig. 2 is an end elevation, showing the cylinder end of a similar locomotive engine which has been constructed with improvements according to my invention. In these, and some of the other figures, stuffing boxes, screw bolts, and other well-known parts are omitted, as not being necessary to be shown for the explanation of the descriptions of this part of my invention, or the applications thereof.

O is one of the cylinders, which I will call the first cylinder, furnished with a piston *o* and piston-rod, as shown in fig. 1; also two steam ports *a* and *b*, but no exhaust port. P is another cylinder which I will call the second cylinder, similarly furnished with a piston *p* and piston-rod, and I prefer in every case to make the second cylinder of a greater diameter than the first.

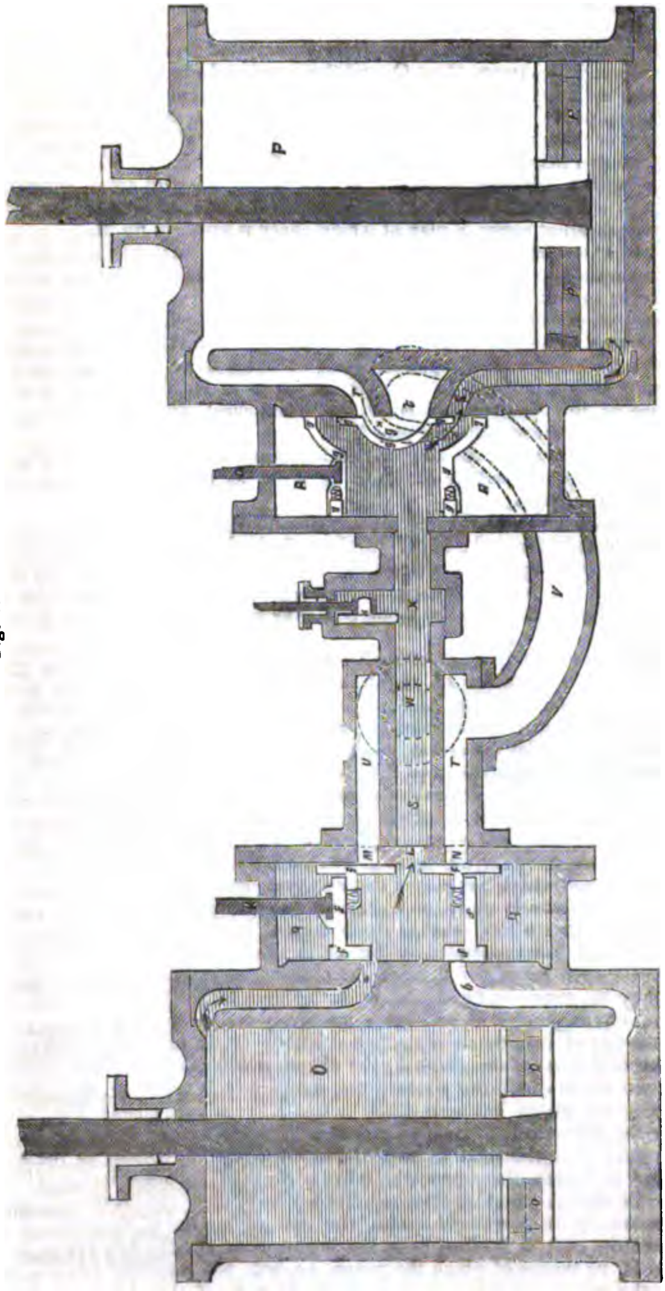


Fig. 1.

Q is the steam chest attached to the cylinder O; Z (fig. 2) is the steam pipe; R is a chest attached to the second cylinder, similar in form to the chest Q, but used chiefly to protect a valve which works within it.

S X is a pipe along which steam is communicated from either end of the first cylinder through the steam-chest Q, and the opening L, in the steam-chest cover, to the second cylinder. T U is a chamber or chest, surrounding the pipe S X; V is the exhaust pipe for conveying the steam ejected from the second cylinder to the blast pipe or chimney; *f* is a hollow slide valve, which works in the steam-chest Q, motion being given to it by means of the rod K. This valve is made in two parts, with a telescope joint or slide, and furnished with spiral springs to keep the faces or sides of the valve close up against the side or face of the cylinder O and the steam-chest cover, a plan of which cover is given in fig. 3.

Fig. 4 is a section of the valve *f*, and the several parts of the same valve are shown separately in figs. 5, 6, 7 and 8. Fig. 5 is a plan of the face of the valve, which works against the face of the cylinder; fig. 6 is a plan of the opposite side of the same part of the valve, showing the opening, into which is fitted a telescope joint or slide as before mentioned, and this opening is also shown in the section, fig. 4.

Fig. 7 is a plan of a plate, upon the back of which there is a ring which fits into the opening shown in fig. 6 just mentioned, so as to form a joint or slide, and the outer face of the ring works against the steam-chest cover, an opening L being made through the cover into the pipe S X.

Fig. 8 is a side view of the ring or packing represented in fig 7, showing the slide which fits within the orifice shown in fig. 4, so as to make the telescope or slide joint before mentioned.

I have not shown in the figures already mentioned any steam pipe for conveying steam immediately from the boiler to the cylinder P, but I prefer to furnish that cylinder with such a pipe and a stop cock, so that if it should become desirable (more particularly at the time of starting the engine), to work that cylinder by means of steam direct from the boiler the steam pipe may be used in the ordinary manner for that purpose.

The fig. 8 shows the piston *o* of the first cylinder O, when it has nearly reached the bottom of a downward stroke, or stroke towards the bottom of the cylinder, the steam from the boiler having been cut off at half stroke, and the piston *p*, of the second cylinder P just commenced an upward stroke—being propelled from the bottom of its cylinder by steam passing from the upper side of the piston *o*, in the cylinder O, through the pipe SX, into the bottom of the cylinder P. As the piston *o* of the cylinder O descends further down that cylinder, the valve *f* will ascend, and the upper port, *a*, of the same cylinder will be opened to such an extent as to admit the passage of a free supply of steam along the pipe SX to the cylinder P. The further ascent of the valve *f* will close the opening L in the pipe SX, and confine the steam which has passed through that opening in such a way as to compel it to act expansively upon the bottom of the piston *p*, and propel it upwards.

When the piston *o* has reached the bottom of its downward stroke, or nearly so, the valve *f* will have ascended so far as to admit the steam remaining above the piston in the cylinder to pass through the opening M and pipe U, into the blast pipe, or chimney W, shown in fig. 2, and by dotted lines in fig. 1. The steam which has passed into the cylinder P, will act expansively and propel the piston *p* upwards, and as the rod of that piston is connected with a crank placed at a right angle with the crank of the rod of the piston *o*, the piston *p* will move upwards rapidly during a space of time in which the piston *o* has, comparatively speaking, very little motion. And when that piston has arrived at the top of its upward stroke, the valve *q*, will have moved downwards to such an extent as to open a communication by means of the concavity *o* in the valve Q, with the exhaust-pipe V, leading to the blast pipe, by means of which, the steam which has performed its office in the cylinder P, is ejected into the blast pipe or chimney. Immediately after the piston *o o*, has arrived at the bottom of its downward stroke, the upward motion of the valve *f* will have uncovered the port *b*, leading from the steam-chest Q, into the lower part of the cylinder O, by means of which the piston *o o*, will be propelled towards the other end of the cylinder so as to make an upward stroke of the piston and (steam from

the boiler being cut off at half stroke), by the time that the piston *o o* has proceeded a little beyond its half stroke, the communication through the opening L will be again opened, and a portion of the steam which is now propelling the piston *o o* will escape from the lower port of the cylinder O, pass along the pipe S X, and the position of the valve *q* having now been altered, so as to close the lower port of the cylinder P, and open the upper port of it, the piston *p p* will be propelled towards the bottom of that cylinder. The motion of the valve *f* will then again cause the opening L to be closed, and at, or a little before the completion of the upward stroke of the piston *o o*, a communication will be made through that valve, and the opening, N so as to allow the steam remaining below the piston *o o* to pass along the pipe T into the blast pipe or chimney; the steam confined by the closing of the opening L will afterwards by its expansive force cause the downward stroke of the piston *pp* to be completed in like manner as its upward stroke was made, and the upper port of the cylinder P being then opened by the passing of the valve *q*, the steam contained in that cylinder will pass through the upper port *r* of that cylinder, and through the concavity *q* into the pipe V, and the blast pipe in like manner as before described.

[An engine which has been constructed on this plan, and been some time at work, has, we understand, given hitherto great satisfaction—particularly as regards the saving of fuel effected by it, which is stated to be something quite extraordinary.—Ed. M. M.]

MR. GIBBS' PATENT ARTIFICIAL STONE, MORTARS, AND CEMENTS.

We had only space in our last (p. 397) for the claims of Mr. Gibbs, and now propose to lay before our readers his specification *in extenso*, which will be found well deserving of this fuller notice. The first part of it contains a body of information on the subject of mortars and cements, and the localities where the materials of them are to be obtained, of a kind rarely to be met with in such documents—much of it entirely new, and all of it of the highest practical importance.

Specification.

The several descriptions of Roman cement are made from the septaria of either Harwich or Sheppy, or from the septaria of the lias formation, or from beds of cement stone found in the upper division of the lias formation, or in the shale beds of the Kimmeridge clay. All these stones, when manufactured, produce a material of a dark brown colour, unfit for incrusting buildings so as to imitate stone, unless they are either coloured by washes or by painting. Now amongst the advantages to be obtained from the cements and mortars I have invented is this, that every description of freestone may be exactly imitated without any wash or painting whatsoever being applied.

Again: the cement called Portland cement is made by mixing clay and chalk, or river mud and chalk, in such proportions together that the combined materials may contain about the same proportions of lime, silica, and alumina as are found in cements. These materials are ground together in water to a great degree of fineness. After subsidence, and also after obtaining the proper consistency, the pasty materials are dried in kilns or otherwise, and afterwards burned like ordinary cements in calcining kilns. The materials are then ground in proper mills. To these materials, so prepared and so ground, are added from one-third to one-half of their weight in slag of copper smelting, or other furnaces, or the slag of over-burnt cement, which, combining with the lime and silica, forms a cement which is much nearer the colour of stone than any of the Roman cements heretofore made. Now as the combination of chalk and clay, or river mud, is expensive when manufactured, and causes these cements to be very dear; and further, as the materials are only combined, mechanically and not chemically, there is neither uniformity in their quality nor can reliance be always placed on their stability; the object of my invention, therefore, is to lessen the expense of manufacturing artificial stone, mortars, and cements, and produce a superior quality of cement to those now in use.

My invention divides itself into three

parts; the first of which relates to mortar and cements, the second to the manufacture of artificial stone, and the third to the modes of manufacturing the said mortar cements and artificial stone.

I have found by research, analysis, and much experience, that there exists in nature vast beds of argillaceous marls and marly limestones, or marl stones, which contain the due admixture of lime, silica, and alumina, from which hydraulic cements and artificial stone may be manufactured. The principal places for finding this marl and marly limestone (geologically speaking) are the chalk formation, the Wealden formation, the Purbeck beds, the lias formation, the mountain limestone, and the lowest strata of the coal measures. In the chalk formation, the marl will be found immediately at the junction of chalk with and just above the green sand, in that division of the sand usually called "gault," or at such places where the fire stone (or as it is sometimes called the "malm rock") exists, interposing between the gault and the chalk marl. This chalk marl possesses a varying character, increasing in the amount of silica and alumina as it approaches either the malm rock or the gault; in fact, sometimes when there is no malm rock (or fire stone), the gault becomes a calcareous m r, charged with sufficient lime to make a cement, but the amount of the silica and alumina, and lime composing the marl, can only be ascertained by experiment. The upper beds of marl, and those nearest to the greystone rock of the chalk formation will make hydraulic mortar quite equal, and often superior to the best lias lime; and the lower beds will make cement equal to Roman cement, except that it does not contain a very noticeable quantity of either manganese or iron; consequently it is of a light stone colour when manufactured, and is better adapted to cover buildings, and represent stone. The chalk marl may readily be found by the springs of water which issue from the back or escarpment face of the chalk formation, and above these springs (but in close proximity thereto) the hydraulic lime will be found, and below the springs the material for making cement must be extracted.

The proper place for obtaining the marly limestone in the Wealden formation, is in what are termed by geologists the Ashburnham beds, above, and below, and in immediate contact with the Ashburnham limestone. These limestone marls are like perfect limestone when first extracted, but decompose by exposure to the air after a short time. The limestone itself in particular localities sometimes becomes a cement-stone or marlstone, which may be known by its not slackening in water after calcination.

The material for making cement out of the beds of Purbeck limestone is obtained from some of the partings which divide the ordinary Purbeck beds of limestone, and is exceedingly well calculated to make a cement of great purity and whiteness; but all the beds do not contain in their partings the quality desired, but the proper material may be readily found by noticing the decomposing character of the shale when exposed to the air.

The materials which I extract from the lias formation, locally called "rummell" at the lime quarries at Barrow-on-Soar, in Leicestershire, is an especial bed of marly limestone, found above and separated from all the lias beds of limestone in that district. The same bed of "rummell" is found in other districts of the lias formation, and may be readily observed on the coast of Dorsetshire, near Lyme Regis. It is seen on the face of the limestone cliffs, embedded in a marly shale, the whole of which decomposes after exposure to the air. This bed of "rummell" has no local name in the district of Lyme Regis, not having hitherto been applied to any useful purpose; but it may be easily found, as it exists in a deep bed of shale between the lias limestone beds and the beds of cement stone which heretofore have been worked, and are so now (but the cement from this last-named stone is of a deeper brown colour, and unfit for imitating stone, whilst the bed of "rummell" will make a cement of a light colour exactly like freestone.)

In some cases, as when I use the hardening materials (to be hereafter described) in combination with the calcareous marls from the lias formation, I use some of the partings of calcareous shale existing between the lias beds of workable limestone, provided such calcareous partings or shale beds contain sufficient lime, which shale, after calci-

nation, I combine with the hardening material in the manner hereafter to be directed, either by itself or in combination with the "rummell" of this formation along with the hardening materials.

The materials which I extract to make cements from the mountain or carboniferous limestone are only found in the upper part of that great deposit, and must be sought for in or at the immediate junction of the limestone shale (which shale lies under the millstone grit, and above the mountain or carboniferous limestone dividing the two formations.) These materials consist of mountain limestone, limestone shale, and bastard limestone (that is the limestone which will not slack after calcination, but still retains its shape after being dipped in water.) These two materials are found above the beds of workable limestone, which beds are wrought for making ordinary limes (the shales and the bastard limestone or limestone marl being always found together). These shales produce a dark cement, but the bastard limestone produces a cement of a light stone colour, and therefore more fit for imitating stone.

In addition to these substances, I extract from this formation sparry iron stone, to make hardening material with.

The materials which I extract from the coal measures for making cement or for mixing with the other cementitious materials, are found only in the lowest beds of the coal measures, often connected with the last two seams of coal, and before that strata, the millstone grit. These cementitious materials consist—first, of the coal shale (called metals by miners), and round septaria nodules (called boilams by the local miners about Congleton, in Cheshire.) The "metals" will not in all cases make cement, but most of them in contact with the boilams (or septaria balls) will do so. These boilams are composed chemically of sulphur, lime, iron, and manganese, and are therefore easily distinguishable; they are, in fact, a species (as well as the "metals") of pyrites. The "metals" and the septaria balls make excellent cement, of great hardness, but of a dark colour. I use, however, this cement, as well as other materials, in mixing with some of the cements I have before specified, to give them hardness—the process of doing which, and the nature of the materials, will be described hereafter: such materials will be called "hardening materials.'

When any of the materials just enumerated are to be made into cements, the usual course of proceeding for making cements is to be followed; that is, by burning in kilns and grinding in mills, in the way cement is now manufactured; but I recommend that the marls and marlstones be first dried in kilns or ovens, at a baking heat fit for baking, until all moisture be driven off, and that then the calcination be prolonged as much as possible, but that the heat be kept so low as is only just sufficient to effect complete calcination—this being indispensible to avoid the commencement of vitrification, which would destroy the adhesive properties of the cement. These observations will be found equally applicable to kilns such as are now in use, or to the kiln of the improved description to be described hereafter, and which forms part of this invention.

Although I have described certain new materials for making cements and mortars therefrom, and such materials are capable of forming good cements without any admixture whatever, yet in some cases I make a composition of the various cements to obtain particular qualities: thus, for instance, I take a quantity of the pyrites septaria called boilams, and mix it with an equal quantity of the chalk marl before described. In this case the chalk marl keeps the colour light, and the septaria or boilams of the coal measures before described gives to the chalk marl a considerable degree of hardness. I also make a mixture of equal parts of the bastard limestone before described for a like purpose, and with the same result; but with the "rummells" of the lias formation before described, or the rich argillaceous shale of that formation, not more than one-third or one-quarter part by weight of the septaria or boilams is needful to give great hardness and strength to the cement made therefrom. The same observation applies to the cement stone of the Ashburnham beds already described, as well as the cement made from the interposing Purbeck shale partings.

But in many cases a cement is required of a hardness beyond what would be afforded from either of the cement stones I have described, or the mixture of two

or more of them together; and in these cases I use substances to be combined with any of these cement stones or their mixtures, which I have called "hardening materials;" these materials (in addition to the one I have described, namely, the pyritous septaria or boilams) consist—

First. Of the slag or cinder derivable from iron blast furnaces.

Secondly. Slag from puddle furnaces, or from reheating or mill furnaces.

Thirdly. Slag derivable from copper, lead, or tin furnaces, or the slag from cement kilns.

Fourthly. The sparry iron of the carboniferous strata.

Fifthly. The pyritous earth known by geologists as Folkstone pyrites, which pyritous earth is a thin lamina, or bead, or band of earth, in concretions just below the gault strata, and which it separates from the rock and sand bed just below the gault. The pyrites may be found in other places in similar positions; but the locality just indicated, namely, Folkstone in Kent, will be a sufficient guide to find a similar material elsewhere. This pyritous earth may be calcined in ordinary lime kilns, the same as the cement stones I have before enumerated. If this pyrites be mixed with chalk marl or any other of the white cement stones I have before mentioned, the imitation of stone will be very exact, and may be sculptured afterwards with the same facility as ordinary freestone. The same effect may be produced by mixing in the like proportions this calcined pyritous earth with the artificial hydraulic cements now commonly made (and which cements are composed of chalk and clay, or mud, in due proportions, and ground together before calcination)—the pyritous earth or Folkstone pyrites displacing in this case the ground slag with which such cements are now usually combined.

The various slags and cinders require only to be ground under edgestones to a fine powder, and then to be mixed with any of the various cements I have enumerated; namely, the cement from the chalk, the cement from the lias, the cement from the Wealden and Purbeck beds, the cement from the mountain limestone, and the cement from the coal measures; these mixtures must take place by sifting the materials together, or by some other mode which will effectually incorporate and combine them; and the quantities may be generally from one-quarter (by weight) to one of slag, mixed with one of calcareous cement.

In some cases I grind pyritous septaria of the coal measures, or other equivalent materials (having the same chemical properties), into a fine powder, and mix such powder with about its equal weight of some of the calcareous marls after they are made into cement, instead of mixing such marls with the slags or with the calcined pyrites of Folkstone, as before directed. In other cases I mix with the cement made from chalk or other marls an equal weight of any of the cements now in use, or of the calcined septaria of the London clay basin called Roman cement stone, more especially that part of it which is called sandstone; but in the case of using any of the septaria of the London clay, the marl and the stone may be calcined, and ground together in equal proportions, or thereabouts.

Having now described that part of my invention which relates to the composition of mortar and cements, I declare that what I claim in respect thereof is as follows. (For claims, see *ante*, p. 397).

I desire it however to be understood, that I do not claim the use of those cement stones which are extracted from the coal measures, and which are usually found in connection with or above the beds of white iron stone, and contain little, or scarcely any sulphur. Neither do I claim the use of ground slags, when used in combination with slacking lime, or with artificially formed cement, that is, cement composed of lime and clay, or mud mixed together.

II. The *second* part of my invention, which relates to improvements in manufacturing artificial stone, I perform in the following manner:—I take any of the cements I have before described, either simple, or in combination with the hardening materials, or mixed with each other, or I take any other water cement now in use, which may either be combined with ground lime stones, or used by itself, as may be desired, for either fine or coarse works. The cement selected for the purpose, I put with much less than the usual quantity of water to make it plastic, into a mortar, or other strong convenient vessel, and pound it with considerable force, instead of merely

mixing by hand as is usually practised, and in proportion to the force applied to it in pounding, so will the cement become indurated after setting; or instead of a mortar, I use hollow or tubular hammers of large size, into the heads of which hollow hammers I put the cement and water; the hammers are then struck with considerable force upon some hard unyielding substance; the concussion of the blow will cause the cement within these tubular hammers to consolidate in setting, and become equally hardened as that which has been pounded in mortars. Or in some cases, I work the cement under heavy edge runners, in the same manner as mortar is now ground. When I desire square tubes, or other shapes to be formed, or large masses of cement to be mixed or made up, I make a strong metallic receptacle, the interior of which will correspond with that of the outside of the article to be formed. This receptacle is to be elevated, and then allowed to fall by repeated blows, the concussions of which will cause the block or other article to be so consolidated, that it will be, after standing a short time, equal in hardness to freestone (provided the cement be good.) The block, or other article, may be allowed to remain for a short period previous to taking it from the mould.

The process of pounding, or of causing concussions by hollow hammers, or by elevating and letting fall strong metallic moulds, may be carried on by mechanical arrangements and the application of power, but as such mechanical arrangements are well understood by competent mechanics, they will not require to be explained here.

When I design to make a building itself like a solid mass of stone, I first prepare two lattices or trellises of wood, as large as one of the sides of the building (and so of all the rest of the building). These lattices are set up at a distance from each other, of a little less in thickness than the size of the wall intended to be built between them. Concrete made with cement, or lime, and burnt clay broken small, or of pebbles and sand in the usual proportions for making concrete, are poured in between these lattices. A small portion of this cement will exude through the openings in the lattices, and effectually key them together; the concrete must be run horizontally in layers of about 6 inches thick, and each layer must set before another layer is put on. After the lattices are filled up, the outside must then be plastered over with cement on each side, so as to enclose the lattices, and then the whole will be as solid and perfect as though the building was made from one block of stone only.

The lattices may be made of wood, one-quarter of an inch thick, and one inch wide, leaving one inch and a quarter between them; or they may be put up like laths; but it is not so good a method as putting them up like lattices. Of course these dimensions may be varied according to the thickness of the wall. When it is thought advisable to dispense with the lattices, and to make the wall without any part of it being composed of wood, then, in such cases, blocks of the size of the stone which the wall would be composed of under ordinary circumstances, are to be cast; only these blocks are to be hollow, having only sides and ends; the sides and ends being made about 2 inches thick. After every course of these blocks has been built, the hollows must be filled with concrete, like that before described. The blocks being made to break joint with each other, and being filled with cementitious matter, the wall will become one mass of solid artificial stone, so that there will be no necessity to put mortar between the blocks to bed them. Instead of the blocks being cast in the shape of hollow parallelograms, they may have merely a back and face, such back and face being held together by only as much cement or other material as will keep such back and face in parrallelism with each other during the time they are setting, (after which the filling must be the same as before). It will be well to wet the blocks before concreting cement is put in, so that they may all unite to form a solid mass of artificial stone.

Having described the second part of my invention, I declare that what I claim in respect thereof, is as follows. (For claims, see *ante*, p. 398.)

III. The third part of my invention consists of three several improvements in the modes of manufacturing artificial stone, mortar, and cements, which improvements have for their object to effect a more perfect and rapid calcination than can be accomplished in the kilns now in use.

The kilns, especially the drawn kilns now in use, are apt to become more heated in one part than another, by which means some portions of the substances to be calcined are often underburned, whilst other portions are vitrified.

Now the kilns I use, admit of the most minute distribution of heat, so that all parts of the materials may be burnt equally; besides the marls and marlstones I employ are so pliable, that there is great difficulty in subjecting them to an equal calcination.

Fig. 1 represents a section of a square kiln; fig. 2, represents a transverse section thereof; AA, in each figure is the outer wall, both figures being lettered the same; BB is one of several vaults running under the kilns; EE, are each one of several fire-places communicating with the vaults, BB, respectively. These vaults

Fig. 1.

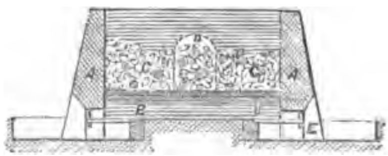
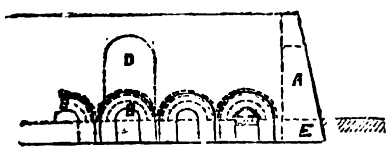


Fig. 2.

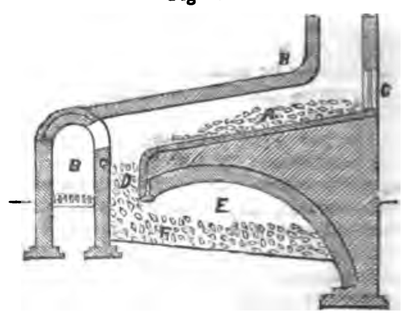


are built not only in the arches, and floors above the arches, but also the sides or piers, with bricks of a peculiar shape (the form of which will be described hereafter); these bricks are to be put together without cement, or other adhesive matter, so as to admit of a free passage of air past their sides and top. By this means one vault cannot be materially heated more than the other, the consequence of which will be, that the heat under the materials to be calcined must be equal, and will be gradually distributed through the pile of calcareous substances placed above the fire vaults. The calcining materials are represented at CC, and are put on the kilns through the door DD, which door is carefully walled up after the kiln is charged. I am aware that vaults are sometimes built under kilns either of dry bricks or of the calcining materials themselves; but these vaults are of a temporary kind, and are removable on the charge of each kiln being withdrawn, whereas the vaults I use occupy the whole area of the kiln, and are permanent, and communicate with each other to equalize the heat in all directions. The upper part of the kiln may be arched from the wall A to the wall A, if it is thought advisable: after the calcination is complete, the opening to the fire vaults must be closed until the charge is taken out.

Fig. 3 represents a brick for building the fire vaults, described before; these bricks should, for convenience, be composed of two cubes, that is, if the brick is 8 inches long it ought to be 4 inches wide, and 4 inches deep, the bricks being made for the arches with a bevel conformable thereto; on the corners of this brick,

Fig. 3.

Fig. 4.



and also in the middle, there must be placed small projections, as exemplified at A, B, C, D. The projections in the middle of the brick must be double the lengths in the direction of the length of the brick to those at the corners. Vaults or arches built with these bricks will form heat space, or leave interstices between them and communicate heat in all directions. It is with bricks of this description that I construct the fire vaults and other parts of the work connected with the distribution of heat.

Some of the calcareous marls I use are naturaly in such a state of disintegration (especially the chalk marls), that to calcine them a kiln of any sort is scarcely admissible. To overcome this difficulty,

I use a reverberatory furnace of the construction represented in fig. 4; this furnace has a very large sole or floor, on which the marl is strewn, as shown at E. B is the fire-place; C is the bridge; D is a passage opening to the vault E; F is the body of the calcined materials closing the passage D; C is a door at the back of the furnace, through which instruments can be introduced to stir up the matters being calcined, and to push them gradually forwards towards the passage F, leading to the vault. The furnace may be fed by the door G, or by an opening about H, as may be found convenient. Doors may also be made in the sides of the kiln or furnace, to facilitate the operation of calcination.

When large quantities of materials are required to be calcined, I construct a kiln, as represented by figs. 5 and 6, AA, AA, represents an outer boundary wall; BB, BB, an inner wall, not so thick, but sufficiently so to retain the heat; CC, CC, the space for the materials to be piled inside. DD, fig. 6, is a section of an inverted arch formed of bricks of the shape represented at fig. 3; this arch has proper external openings to communicate with, and supply air to the inverted arch and to the burning materials. The mode of proceeding is as follows: From E to F and G, the kiln is filled with the material to be calcined, properly mixed with fuel, the

Fig. 5.

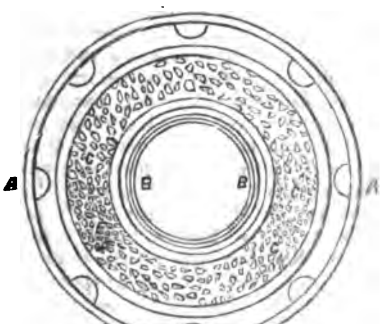
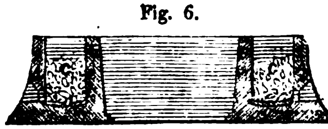


Fig. 6.



rest of the kiln being empty; as the burning proceeds the calcined materials may be taken from G, and an equal quantity of fuel and calcareous matter may be put in the kiln at E. By proceeding in this way the operation is continuous, and the kiln will always have the same quantity of charge in it, and the operation will circulate all round it. If required, the top of the kiln may be vaulted over, and openings may be made in the side of the kiln, but which openings must be walled, or closed up on the charge coming to that side of the kiln, except those which communicate with the inverted arches, DD.

Having described the third part of my invention, I declare, that what I claim in respect thereof is as follows. (For claims, see *ante*, p. 398.)

THE DOVER HARBOUR OF REFUGE.

Our readers cannot fail to remember the long discussion which some time back took place in our pages respecting the comparative merits of vertical and sloping sea-walls. One of the chief grounds on which the majority of the Harbour of Refuge Commissioners—including all the younger and least experienced members—rested their preference of vertical walls, in opposition to the able and scientific "Protest" of the senior member General Sir Howard Douglas was, that waves exert *no horizontal percussive force*. The events of the last autumn in regard to the new harbour at Dover have furnished a memorable commentary on the soundness of this doctrine. The harbour had been begun and carried on to some extent on the vertical system—and an immense quantity of hoarding and scaffolding set up for the purpose, with ample store of cranes, monkeys, diving-bells, trucks, &c. Well, there has been one violent gale, and after that a second of less violence, and between them—their supposed freedom from horizontal force notwithstanding—they have swept the whole of these works away — leaving standing only so much of the walls as by dint of sheer bulk and weight, strong iron clamping, and a dense "hearting" of concrete, opposed more inert force (science and skill discarded) to the waves than the waves were capable of overcoming. Large rectangular masses of stone, weighing two and three tons each —where not secured by clamps to other stones, or kept down by superincumbent weight—were moved about or dis-

placed by the waves, as if they were little more than so many pebbles.

All this, too, has taken place while as yet the operations of the engineer have extended no farther than to the carrying out of a single pier or jetty *from the main land*, and in (comparatively) shallow water. What, then, may we reasonably expect when the work advances farther into the sea—when it is carried beyond the opening which is to form the south-west entrance of the harbour—when the work will no longer be that of merely lengthening out an existing foreland, with all the facilities arising from such proximity, but of constructing a separate breakwater in seven fathoms (low) water—constructing, in fact, in the open sea an oblong island composed of perpendicular walls of chiselled stone? In the first place, the whole of the expensive building machinery, which has been just swept away, must be replaced at twice or thrice the original cost, owing to the increasing depth of the works; and, secondly, unless future autumns should prove more propitious than they have done on an average of past years, the same thing will have to be done over and over again before the works are finally completed. Talk of the harbour costing but a million or two, and of a year or two sufficing to build it in! We have sufficient before us to warrant a strong belief that the entire cost will not fall short of ten or twelve millions, and the time of execution be at least as many years. Parliament, we trust, will immediately resume the matter into its hands, and cause it to undergo a thorough re-sifting and reconsideration.

Postscript.—We observed recently in the *Times* a letter from Lieut.-Col. Yule, R.E., in which he recals to public attention a mode of protecting such undertakings as this while in progress, which he proposed in vol viii. of the *Professional Papers of the Corps of Royal Engineers*, and afterwards confirmed by experiments, of which an account is given in No. 1299 of the *Mech. Mag.*, July 1, 1848:—"The theory (Lieut.-Col. Yule's) is, that if one spar can be so anchored, in imitation of reeds, as to resist the force of waves, so can hundreds, or any number; by means of numbers, as yet indefinite, still water will certainly be obtained. The late Admiral Sir Edward Owen informed me that during a storm on one of the lakes in Canada he found shelter to leeward of reeds. I first tried a single spar. I then incurred the expense of anchoring 600 short spars, forming a group of 30 by 20. It would require a Government purse to adopt the scale of thousands, so as to have a group of at least 100 spars in breadth. Supposing that the necessary number of spars were ascertained, they might be placed round a portion of the wall to be raised, and when that is completed they can be taken up and anchored again, at very little expense, around the site of another portion of wall."

We have not a doubt that, had the Dover works been thus protected, the greater part of the waste and destruction which have been caused by the recent storms might have been averted.

We may mention here also a note we have received from Major Parlby, reminding us that he obtained, in January, 1843, a silver medal from the Society of Arts for a plan of forming breakwaters very similar to Col. Yule's.—(See *Mech. Mag.*, vol. xxxix., p. 24.)

MATHEMATICAL PERIODICALS.

(Continued from page 367.)

XXIV.—*The Lady's and Gentleman's Scientifical Repository.*

Origin.—The first number of this serial was issued in December, 1782, under the title of "Number I. (for January, 1783) of the *Lady's and Gentleman's Scientifical Repository*, containing Enigmas, Rebusses, Paradoxes, Philosophical, and other Useful Queries; Arithmetical and Mathematical Questions and Problems, with their respective Solutions (to be published monthly), BY A SOCIETY OF MATHEMATICIANS." In a notice to "the Reader," the editors declare that their sole motive in establishing the work "is to promote the study of solid knowledge in science and virtue:" correspondents are therefore "requested to make use of sublime subjects, to deal in such matters as will be both useful and edifying, and to abstain from abstruseness and *indecency*, as nothing but what is useful and modest can be admitted into this work." The last restriction and assurance was no doubt rendered necessary on the part of the proprietors of such a publication as this,

in consequence of the *then* notorious *indecency* and *immoral* tendency of many articles admitted into the *British Palladium* by Captain Robert Heath (see *Mech. Mag.*, vol. l., pp. 466-75). The moral and religious feelings of the reading public had long been outraged by the general contents of the last-named and other publications of like character, and hence the necessity for an assurance that the new candidate for public favour should contain nothing derogatory to the best feelings of human nature. The editors hope, by "persisting in these intentions, youth will be stirred up to emulation; and by meeting with proper encouragement, attain the knowledge and practice of that good which will make them useful members of society in this life, and prepare them for a blessed futurity." Four of the first numbers were issued *monthly*, at the rate of 3*d*. each; but owing to "the loss of Dr. Conundrum, *junior*," and the frequent complaints "of the short space between the publication," the remaining numbers were "enlarged and published every three months, at the price of one shilling." So far as I am aware, the publication was discontinued with "Number X., for August, September, and October, 1784."

Editors.—No formal statement is made either in the body of the work or elsewhere, which absolutely fixes the editorship upon any individuals; but from the nature of a communication inserted in the first number from Mr. William Spalton,—another in No. 4 from J (oseph) G (ales),—and "the Printer's Apology" on the cover of No. 10, I am led to conclude that these gentlemen had the principal management of the publication.

Contents.—The title-page, given at length under the first head, sufficiently explains the usual contents of each number. With the exception of adding occasional "Tables of Fixed Feasts, Remarkable Days, Eclipses, &c.," the original plan was strictly adhered to; but on the completion of No. 10, it was announced that in the "next number, and future ones, will appear *original* poetical pieces, agreeably to the wish of several correspondents." No additional essays, either on mathematical or philosophical subjects, appear to have been admitted, if we except some remarks on timber measuring, by Mr. William Spalton, from which it may be inferred he considered himself somewhat injured by the treatment he had received from the editor of the *Palladium*, on proposing a question relating to the same subject in the number of that work for 1778. The enigmatical department is well sustained, and contains many pieces worthy of commendation: the same, however, cannot be said of the portion devoted to Philosophical Queries, &c., these being mostly discussions and questions of a very trivial character.

In the earlier numbers *prizes* were awarded "for the best enigma," "the best versified answer to all the enigmas," "for the best general answers to all the mathematical questions," and "for the best general answer to all the arithmetical questions;" but in No. 5, an announcement was made that "*in future they will be withdrawn, as they only create jealousy; and merit needs not a prize to distinguish it.*" The succeeding number repeats the announcement, and thus paraphrases this, perhaps necessary, determination:—

"No more the Editors intend to give prizes,
For one writer praises—another chastises;
Presumptuous 'tis, too, forming the public a scale,
Against which they can by no means prevail:
Let each candid reader his opinion maintain;
Worth will e'er be distinguished in *Wisdom's* bright train."

Questions.—In several of the earlier Numbers, the mathematical questions were classed under two heads; viz., arithmetical and mathematical. Of the former, 46 were proposed and answered, and of the latter 176; besides which No. 10 contains a selection of 24 "new questions," whose solutions, so far as I am aware, were never published. The arithmetical questions include all those which are capable of being solved *numerically*, without any reference to the particular branch of mathematics to which they might happen to belong:—those included under the second head embrace all the ordinary subjects of mathematical inquiry. Many of these exercises would furnish good practical examples for the correspondents of the *Repository*, but they offer few points deserving of particular mention.

Ques. 5 (No. 2), by Mr. George Reed, gives "the area of a right-angled triangle, and the area of its inscribed square, to construct it;" which is neatly

done by Mr. William Close, of Armley, near Leeds.

Ques. 6 (No. 4), is proposed by the same gentleman, and requires "from two given points, to draw *geometrically*, two right lines, so that meeting in a third right line given in position, the sum of the squares described on them may be a minimum:"—an elegant solution is furnished by Mr. John Ingham, of Harewood, near Leeds.

Ques. 12, 13, 14 (No. 6), relate to the construction of triangles from given data, and though they furnish valuable exercises in analysis, are too long for transcription.—The 13th was proposed by Mr. Thompson, and the two latter by Mr. Collis. Complete and elegant geometrical solutions were given by Mr. Joseph Saul, of Harewood, near Leeds, afterwards master of Rochdale Grammar School, and author of a "Treatise on Arithmetic."

Ques. 15, 16 (No. 6), are proposed by Mr. Saul, and require:—

1st. "From one end B of the diameter AB of a given semicircle, to draw a right line BD, cutting the semicircle in C, and meeting a right line PD in D (PD being perpendicular to AB at a given point P) so that BC and CD may have a given difference."

2nd. "It is required to draw a chord CP within a given circle to a given point P in the periphery; such that being produced till it meets a line given in position as at A, the rectangle of the chord so produced (AC) and the produced part (AP) may be a given quantity." Good solutions to these questions are supplied by Mr. Patrick O'Meekly and Mr. Collis; who observes, that the latter question includes "the 5th in *Lady's Diary* for 1783."

Ques. 20, 21, 22, 23 (No. 7); sum the following series:—

$$1.\quad \frac{1}{2\cdot 4}-\frac{1}{4\cdot 6}+\frac{1}{6\cdot 8}-\frac{1}{8\cdot 10}+\frac{1}{10\cdot 12}-\&c.$$

$$2.\quad 1+\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+\frac{1}{3\cdot 4}+\frac{1}{4\cdot 5}+\&c.$$

$$3.\quad x^{x-1}+vx^{x-2}+v^2x^{x-3}+v^3x^{x-4}+\&c.$$

$$4.\quad \frac{1}{v1}+\frac{1}{v2}+\frac{1}{v3}+\frac{1}{v4}+\&c.$$

Of this last series, Mr. Saul remarks, "that the sum of every *fourth* term is equal to that of all the rest."

Ques. 26 (No. 7), requires the inscription of "the greatest ellipse in a given sector of a circle." It was proposed by Hulsiensis, and an elaborate algebraical investigation is given by the proposer in No. 8. A similar question was proposed in the *Palladium* for 1770, but was erroneously solved in the number for 1771, which induced Mr. John Whitley to repropose it; it is Ques. 111, *Boston Enquirer*. An elaborate *geometrical* solution is given by himself in pp. 107-8, vol. iii. Mr. Whitley again reproposed and analysed the problem as No. 1709 in the *York Courant*.

Ques. 19 (No. 10), is proposed by "that ingenious young mathematician, Master Samuel Thompson, of Hull," and requires the curve which is the locus of P under the following circumstances: —"Suppose the right lines AP, BP, CP, be drawn from the angular points of an equilateral triangle, to meet each other in P; P being so taken as that the sum of every of the lines may be equal to the third." Many other questions and solutions from this gentleman occur in different parts of the work, which seems to justify the good opinion the editors had formed of his abilities; as yet, however, I have been unable to trace him in any other periodical.

Contributors.—Messrs. Booth, Brownhill, Cavill, Chapman, Close, Collis, Cromfordiensis, Cross, Dixon, Eadon, Featherstone, Fletcher, France, Gale, Hulsiensis, Ingham, Jackson, Juba, Keith (Thomas), Littlewood, Loxley, Mabbott, Metheringham, Poppett, Saul, Shaw, Smith, Spalton, Dr. Stevenson, Swift, Tattersall, Thompson, Turner, Whitton, Winsor, Youle, &c., &c.

Publication.—The first four numbers were published *monthly*, the remainder *quarterly*. Most of the work was printed "for the Editors by J. Tomlinson, Newark," the rest "by Joseph

Gales, Sheffield," and sold by "all other booksellers in town and country."

THOMAS WILKINSON.

Burnley, Lancashire, November 14, 1850.

Errata.

Page 368, line 2, for *concluded* read *continued*.
" 367, line 2, for *by* read "*to* Poeticus."
" 367, line 6 from bottom, for *Hive* read *Hine*.

MR. RECORDER HILL, Q.C., ON THE PATENT LAWS.

Letter from Mr. Hill to the Mayor of Birmingham.

"44, Chancery-lane, London, November 6, 1850.

My dear Sir,—I have read your letter, and the resolutions on which it is founded, with great interest. I would gladly assist in the excellent object which the Committee has in view, if the accidents of life endow me with power. As it is, I can only throw out a few hints for their consideration, which, if adopted, may serve, in some degree, as a guide for their proceedings.

It is quite clear that the whole system of our patent laws requires revision. It had its origin in times very different from our own, when the principles upon which it ought to be framed were little understood and less regarded. That such revision will be made I cannot doubt: but the work, if it were already in progress, could hardly be expected to be brought to a conclusion before the Committee itself had ceased to exist, and consequently, for all purposes relating to the Exhibition of next year, I should consider it hopeless to expect aid from such a source. I should therefore respectfully advise the Committee to concentrate their efforts against such portion of the patent law as may be expected injuriously to interfere with the objects of that great enterprise.

We shall all agree that, whatever gratification we may receive in the forthcoming Exhibition from the beautiful form, the brilliant colours, or the exquisite workmanship of the countless products of human labour and ingenuity which will meet our eyes, that pleasure will be secondary in the reflective mind to our delight in contemplating the efforts of genius, as developed in the new and striking inventions which will, doubtless, enrich and adorn that high festival of nations.

Here, however, the law as it now stands offers to the most valuable class of contributors an impediment of no common magnitude. Every new invention which they may give us the privilege of beholding will, by that same act of benefaction, be surrendered to the public, unless it has been previously secured by patent. I am now speaking in a practical sense, and I pass over certain legal refinements which might be adduced as impugning in some degree the position which I have ventured to lay down. I believe I shall be found sufficiently accurate for the present purpose.

It is also possible that the late statutes for the protection of copyright in designs may in certain cases afford some imperfect defence, but I need not say to the manufacturers of Birmingham that inventions, in the usual acceptation of the term, are beyond the scope of these provisions; and you are also aware that, as in the case of patents, the conditions imposed by these Acts must have been complied with before the articles can be safely displayed.

The claims of justice, then, seem to demand that some alteration should be made whereby the country may be relieved from the unenviable position of receiving a benefit and inflicting an injury on the benefactor at the same moment, and as part of the same transaction. The feelings I have reason to believe which the present state of the law in this respect is calculated to excite are far from dormant in the breasts of inventors; and that if a change cannot be made the highest department of our Exhibition is likely to suffer serious injury. To remedy this legal defect, I would propose that an inventor, by placing his invention in the Exhibition, shall be in the same state as regards a patent right as if he had previously sued out his patent; subject, however, to the condition that the patent shall be sued out within some reasonable and specified time, or not at all.

The obvious advantages which may be fairly expected to flow from such an arrangement as that proposed will show, I think, the propriety of so framing the Act by which they would be conferred as that the privilege thus created may not be confined to the year 1851, but made permanent, because I think it can readily be proved that although the suggestion for some protection (with whomsoever it had its origin) was promoted by the requirements of that year, yet it would go to supply a want which has long and grievously been felt by inventors.

I scarcely need remind a gentleman so conversant with the commercial history of patents as you must be, that an inventor, instead of arriving in port when he has completed his invention, has to encounter most of the difficulties and all the perils of the voyage—difficulties and perils which he has the more to dread, inasmuch as it rarely happens that he is well fitted, either by

nature, education, or circumstances, to cope with them. The structure of the mind, the training, the habits of life, and very often the humble position and scanty means of the inventor, place him under great disadvantages in the struggle which he must undergo before he can bring the most valuable invention into such public use as shall make it yield him a profit. For this contest a new set of qualifications must be brought into action. The party who bears the expense of a patent, works it, and protects it against invaders, should be in possession of considerable capital; he should be a man of enterprise and wide connections; he should be endowed with commercial courage, steeled against a weary course of disappointments and pecuniary losses—ready to follow his adversaries from court to court. In short, he should be gifted with unvarying resolution, and an eye steadily fixed on ultimate results. He must be content to be ridiculed as a wild speculator until the patent becomes a source of profit, and when that event arrives he must forthwith expect to be robbed by pirates, consisting not unfrequently of the very individuals who had made him their butt. Nor must he forget that the law itself is an ally, sometimes dubious, and always costly—doubt and expense being legal incidents, capable perhaps of diminution, but which I fear it is beyond the reach of human wisdom ever to abolish.

As, then, to invent demands capabilities distinct from those required to carry an invention forward to commercial success (and not a little repugnant to them), it should seem very much to be desired that provision should be made for enabling these tasks to be readily separated, so as to be undertaken by different hands. It is obvious that the present state of the law raises great obstacles to this division of labour between the inventor and the capitalist.

To avoid the forfeiture of his property, the former must be very chary of disclosing his invention, and, consequently, his opportunities of negotiating with the capitalist are few and casual; while, on the part of the latter, his means of forming a just estimate of the value of any invention which he may wish to purchase are very much restricted by the natural jealousy entertained by inventors of those engaged in similar pursuits with themselves; these persons, however, being exactly the advisers from whom, if the choice lay with a capitalist, he would wisely and naturally take counsel.

I apprehend that it must be tolerably clear that some institution is permanently required of the nature of an inventors' mart, in which, for a limited period, inventions may be deposited with a similar privilege to that proposed to be conceded to the exhibitors of next year. I am very sure that such an institution would be hailed as a great boon by our fellow-townsmen, among whom, as you well know, are to be found many individuals whose inventive talent is not combined either with capital or other requisites for commercial success. And it will be an additional recommendation to those whom I am addressing, when they reflect that such an institution would of itself, and without any other teachers than the various objects which it must contain, form a school for inciting and training the power of invention—an establishment of incalculable service to all on whom it has pleased God to bestow this noble gift.

I have now, my dear Sir, written down all that has occurred to me in furtherance of the Committee's desire.

I regret that my contribution should be limited to so very slight a service as that which I have now performed—a service, too, in which I may probably have been anticipated, because, when the public attention is bent on any subject, it is constantly found that the same ideas arise in more minds than one. But neither yourself nor the Committee will mistake my inability to do more for want of zeal in your behalf.

If these hints should furnish materials for a statement of the views entertained by the Committee to the Board of Commissioners, they may perhaps be of more avail than I have expected. It is, I am persuaded, quite impossible for you, who have watched the proceedings of that Board, to doubt its willingness to make an exertion calculated to augment the success of its great undertaking, or to do justice to those on whom that success must depend.

I have the honour to remain, dear Sir, your obedient humble servant,

M. D. Hill.

William Lucy, Esq.,
Mayor of Birmingham.

THE FLAX MANUFACTURE. — EXTRAORDINARY IMPROVEMENTS.—STEEPING SUPERSEDED, AND THE FIBRE ADAPTED TO COTTON SPINNING MACHINERY.

One of the greatest obstacles which has hitherto stood in the way of an extended cultivation of flax, viz., that of the trouble, delay, and expense attendant upon its steeping, in order to prepare it for the market, has now been removed, by an invention which entirely dispenses with that process, and enables the grower at the smallest pos-

sible cost to send his fibre into the market. By this process, of which Mr. Donlan is the inventor, the results are obtained by a combination of chemical and mechanical means, and as it avoids all the expenses connected with steeping, the fibre may be prepared at a cost considerably below that incurred in the present process, and may be made, we are assured, applicable either for fabrics of the coarseness of nail bags or canvas, or of the fineness of the most beautiful Brussels lace. But not only is the expense considerably less, but the time consumed in the preparation of the fibre, which, by the old process, ranges from ten days to three weeks, does not exceed as many hours by the unsteeped mode. It also possesses a vast superiority on account of the extreme simplicity of the means adopted, which may be made intelligible to and performed by a mere child. But by far the most important and valuable part of this invention is, that it produces a fibre perfectly clean, and in its natural state, without any of the stains or impurities which necessarily attach themselves to the fibre during the process of steeping, and it also possesses the advantage of securing that regularity and uniformity of strength which to a greater or less extent is wanting in the steeped fibre. Application has been made for a charter of incorporation for a company which will be prepared to purchase the flax produced upon 100,000 acres in Ireland, at 12*l*. per acre, and to prepare it for the market in cases where the grower may not possess the necessary facilities for preparing it himself.

The uniformity of strength and freedom from stain or impurity which exists in the flax prepared by the unsteeped process, has, within the last four days, led to the practical demonstration of an invention, of the value and importance of which, to the agriculturists and manufacturers of this country, it is impossible to form any adequate idea, and which consists, among other things, of the adaptation of the flax fibre to cotton machinery. The patentee of this invention is M. Le Chevalier P. Claussen, member of the Brazilian Institute, well-known as the inventor of the circular loom, and by his collections of objects of natural history and plants of South America in the British Museum, and in the Museum at Paris. We had placed in our hands a quantity of flax rovings and yarns spun upon cotton machinery by the inventor, and we have had an opportunity of personally inspecting at Manchester the whole process connected with the invention, and the result has fully convinced us of its practicability. The finest portion of the yarn spun, in our opinion, and we were confirmed in it by a gentleman of great exprince and long connection with the cotton trade, was equal in finness to 120's cotton, the coarsest being equal to 50's. The application of such a test as that of 120's for the first time was certainly a most severe one, the result, however, was perfectly successful. A slight difficulty arose at first with the machinery, in consequence of the length of the fibre; this, however, was easily obviated by a slight alteration in the position of one of the rollers. As the fibre, however, may be prepared to any length, there will be no necessity in future for even this alteration, the existing cotton machinery being perfectly adapted for the purpose of spinning flax prepared according to the process patented by M. Claussen.

The patent granted to M. Claussen for England, is for the preparation of flax in a short staple, so as to produce a substitute for wool and cotton capable of being spun upon cotton machinery, and also for the mixture of the materials thus obtained, which can be carded together with silk, cotton, or wool, or separately, as cotton for spinning into yarns. The right is also secured for preparing long fibre as a substitute for silk, for bleaching in the preparation of materials for spinning and felting, and also in yarns and felts. The inventor does not, however, confine himself to flax for the purpose of producing a fibre adapted to his purpose, but states that he can obtain similar results from hemp, jute, Chinese grass, and, to use his own expression, from "an old tar rope, or a bamboo cane."

As the patents are not yet secured for several continental states, we are not at liberty to state the nature of the process, or the means adopted for the purpose of bringing the fibre into the required state. We may state, however, that from 1¼ cwt. of the flax fibre prepared and cleaned upon the unsteeped process, 1 cwt. of a substance, identical with clean cotton, can be produced at a cost for material of less than half a crown. The cost of manual or mechanical labour required in its preparation, including the expense of bleaching, an operation performed in a few seconds, does not amount to more than seven-sixteenths of a penny per pound.

The mixture of the two substances, viz., wool with flax reduced to a short staple, forms a fabric exceedingly durable, while its cost may be judged by the fact, that while wool costs 4s. 6d., the flax prepared and ready for spinning may be obtained for 6d. per pound, so that with flax and wool spun together in equal quantities, the cost would be reduced by nearly one-half.

But although the inventor has obtained a patent for the preparation of a fibre as a substitute for cotton, he does not indulge the visionary and impracticable idea of being able to drive cotton out of the markets, his object being simply to provide a substitute for low cottons, in the manufacture of a variety of fabrics in which that valuable and over-wrought material now forms a part. In a branch of our trade, however, for the supply of which upwards of 770,000,000 lbs. of cotton were last year imported, it is not too much to suppose that there exists ample room for the consumption of very large supplies of home-grown flax, while the facilities which are now found to exist for carding and spinning together flax and wool, must also tend to open up new sources of demand among the manufacturers of Leeds and Bradford.—*Morning Chronicle, Nov.* 14.

PIRSSON'S FRESH-WATER CONDENSER

This is a new description of condenser which is stated to have been used with singular success on board the *Osprey*, an American steamer. We extract the following description of it from an account read by Mr. B. H. Bartol, at one of the meetings of the Franklin Institute of Philadelphia:—

The peculiar feature of this condenser, which distinguishes it from all others previously known to the public, is the placing of the condensing tubes horizontally within the ordinary shower condenser, which is made of enlarged dimensions for the purpose. By this arrangement, the water required for condensation is admitted through the ordinary injection cock, and rises to the top of the external condenser, where it is discharged on a scattering-plate, from whence it passes directly on to the tubes of the internal condenser, which are below it and arranged in three ranges or sets, one above the other; the steam from the cylinder is admitted into the upper range, and passes through the three before being discharged at the bottom. The fresh water produced by the condensation of the steam is pumped out by a small pump and immediately returned to the boilers, while the water used to produce condensation is taken out by the air pump of the engine. The internal condenser is not attached to the external one, but merely laid in it. The three ranges are separately made, and the outlet from the upper slips loosely into the one below it, so that when the whole internal condenser is together, it may be moved from one-eighth of an inch to one-fourth of an inch in any direction. This freedom prevents any liability to fracture from unequal expansion, and the tubes being in vacuum relieves them from all pressure. As the condensing water reaches the bottom of the tubes it is immediately pumped out, so that there is not at any time any water around the tubes other than the thin sheet passing over their surfaces. On the *Osprey*, the vacuum within the tubes of the internal condenser is 26 inches, and the same in the external one; the internal vacuum is the result of condensation, while the external vacuum is produced by the air pump. The *Osprey* has made three passages, or 2,750 miles in all, and has no trouble in keeping a full supply of fresh water in her boilers.

HURWOOD'S IMPROVEMENTS IN GRINDING MILLS.—FURTHER PARTICULARS (SEE ANTE P. 399).

Mr. Hurwood's improvements, though the subject of a great many claims, may be described generally as consisting—

Firstly. In constructing metal mills so that the operation of grinding is facilitated, and so also that the cutting parts may be when required readily replaced.

Secondly. In the application of fans fixed upon the grinding or revolving part of metal mills, to facilitate and improve the operation of grinding by inducing a current of air to pass between the grinding surfaces.

Thirdly. In certain peculiar modes of introducing air between the grinding surfaces of mill stones, to facilitate and improve the operation of grinding.

A mill is first described in which there are employed two cast-iron plates, the faces of which are accurately turned to receive the rings or plates which constitute the grinding surfaces.

These rings (which will be subsequently described) are secured to the cast-iron plates by conical screws sunk below the cutting parts.

The lower plate is secured to the end of the spindle, and made to revolve accurately with the same.

The spindle works in a steel or brass bush fitted accurately in the centre of the bottom plate of the case, as also in a brass step formed of two parts to embrace the onion end of the spindle. The outside is turned to fit the socket, and is prevented turning in it by a stay screw; the socket is also prevented turning in the outer case which it fits by a similar contrivance. A pin from the socket passes through a regulating screw piece, and is coupled to the same by

a screw and washer, so that the screw-piece may turn freely and independently of the socket. It is obvious that by turning the regulating screw, the spindle and plate will be adjusted to the upper plate, consequently the corn or material ground will be regulated accordingly. The upper plate is fitted to the covering plate with a ball and socket joint, which is accurately turned and prevents the passage of the air between these plates, but allows of their being adjusted; the upper plate is held up to the covering plate by a centre ball, which passes through a wrought iron bridge piece, fixed in the same and hung to similar pieces in the covering plate.

The upper plate is adjusted by screws, so as to correspond exactly with the plane of the lower face when it revolves. Three wrought iron fans are attached to the lower plate, which as they revolve disperse and drive the air through the spout, and thereby induce a current of air to pass down the eye-hole, and between the grinding surfaces. The feeding apparatus of the mill is of the ordinary description.

For metal mills of unusual size, air may be employed with advantage to facilitate the grinding, by exhausting or forcing it through the eye-hole to the grinding surfaces—in which case it will be necessary, to preserve the pressure of the air, to close the top of the eye, through the covering of which an arrangement is made for the air and feed pipes to pass. Air may also be introduced to the grinding surfaces of metal mills between the plate and cover; the grinding plates in this case are perforated to allow the air to pass to the grinding surfaces, and the air must be prevented by a ring of leather, and a rim, or some other suitable contrivance, from passing between the cover and plate to the outlet.

The rings or cutting parts above alluded to may be made in various ways and with different materials, dependent in some measure upon the work to be performed, and also the cost.

When made of wrought iron or steel, they are first forged to the shape or punched from plates, then turned true, and of uniform thickness; holes are also accurately drilled, so as to admit of any of the grinding parts being readily removed when worn out, and replaced by others. The drift or angle of the teeth of the rings is not uniform, but is increased in each ring from the centre, to enable the teeth of each ring to discharge its work freely, without clogging or impeding the work of that which precedes it; and this is also to be observed whether the grinding surface be a plane, conical, or of other shape. The rings may also be made of wrought iron, and then case-hardened, or of steel tempered in the usual manner, and fixed to the plates by screws, as before stated.

Or they may be made of chilled cast iron by running hot iron into moulds of the desired form and dimensions, and then cutting the teeth to the requisite form and angle. Whole plates, with the different grades and angles of the teeth cast upon them, may be also made, if preferred, of solid metal.

Metal mills, embodying these improvements, may be also made to work vertically, or with the grinding surfaces of conical form, the case being constructed of suitable dimensions to receive the cones.

The patentee next describes that part of his invention which relates to the ventilating of millstones for grinding corn, which consists in supplying air to the grinding surfaces by pumps or fans, or any of the usual methods of producing a current of air, admitting of the usual mode of feeding and working the stones. The number of openings for the admission of air, and their exact position, must necessarily depend upon circumstances. The apertures must not be so close to the eye as to risk the chance of the air passing up the same, instead of between the grinding surfaces to the circumference of the stones. The case that encloses the stones is ventilated by one or more pipes or openings. Air may be also introduced to the grinding surface from the bedstones. The ends of the admission pipes are in this case cut in a sloping direction, and slightly compressed so as to spread the current of air which is forced through them.

Porpoise Leather and Oil.—The leather tanned from the skin of the white porpoise, specimens of which were exhibited at the Quebec mechanical fair, attracted general attention. The strength and the beautiful finish of the leather were much admired; it is equal in the latter respect to the finest calf skin, and in the former quality is much superior. We understand that these animals are to be found in great numbers on the banks of the St. Lawrence, and that a most profitable business might be carried on in capturing them; not only the skin, but the oil which they contain being very valuable. The specimens sent to Montreal were bought up immediately, and an order given by the Trinity House for a quantity of the oil. The exhibitor, Mr. Tetu, was awarded a premium of 10*l*.—*Quebec Gazette*.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Thomas Coats, of Ferguslie, Paisley, Renfrew, Scotland, thread manufacturer, for certain improvements in turning, cutting, and shaping wood and other materials. November 16; six months.

Joseph Martin, of Liverpool, Lancaster, rice miller, for improvements in machinery and appa-

ratus for cleansing and otherwise treating rice and certain other grains, seeds, and farinaceous substances. November 16; six months.

Thomas Allan, of St. Andrew's-square, Edinburgh, printer and publisher of the "Caledonian Mercury," for certain improvements in electric telegraphs, and in the application of electric currents for deflecting magnets and producing electro-magnets. November 16; six months.

William Laird, of Liverpool, Lancaster, merchant, and Edward Alfred Cowper, of Handsworth, Warwick, engineer, for improvements in machinery for loading and discharging certain descriptions of cargo in ships and other vessels, and in the construction of such vessels. November 16; six months.

John Hosking, of Islington, Middlesex, engineer, for certain improvements in valves applicable to pumps, and also in apparatus to regulate the pressure and flow of water, air, and through pipes. November 19; six months.

Thomas Duron, of Windsor Bridge Iron Works, Pendleton, near Manchester, Lancaster, engineer, for improvements in machinery and apparatus for moving engines from one line of rails to another, and for turning them; also for compressing certain substances, and for raising and lowering heavy bodies. November 19; six months.

Paul de Tolstoy, of Paris, France, General in the service of His Majesty the Emperor of Russia, for improvements in dredging machines. (Being a communication.) November 19; six months.

Clement Augustus Kurtz, of Manchester, Lancaster, practical chemist, for improvements in dyeing. (Being a communication.) November 19; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for an improved composition applicable to the coating of wood, metals, plaster, and other substances which are required to be preserved from decay, which composition may be also employed as a pigment or paint. (Being a communication.) November 19; six months.

Robert Brown, of Liverpool, Lancaster, plumber and brass-founder, for improvements in the application of pumps for raising and forcing water. November 19; six months.

Henry William Ripley, of Bradford, York, dyer, for improvements in dressing and finishing piece goods. November 19; six months.

John James Greenough, of the Strand, Middlesex, gentleman, for improvements in the construction of chairs, couches, and seats, parts of which improvements are also applicable to various purposes where springs for supporting heavy bodies and resisting sudden and continuous pressure are required. (Being a communication.) November 21; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Nov. 13	2532	Martin Billing	Newhall-street, Birmingham	A lithographic perforating and registering machine.
14	2533	Frederic Grosjean	Regent-street	Der Fusswärmer (a railway rug or wrapper).
„	2534	Thomas Foxall Griffiths	Birmingham	Saucepan lid.
„	2535	Lord Brothers	Canal Street Works, Todmorden, York	Improved hook for the weight hooks of lap and other machines.
15	2536	Thomas Foxall Griffiths	Birmingham	Candlestick.
„	2537	Lorant Poirier	Bucklersbury	Improved lithographic press, for printing circulars and other small forms.
„	2538	Jenkins and Wolmerhausen	Curzon-street, Mayfair	Lady's riding habit.
18	2539	Waddington and Son	Coleman-street	Etui bis-utile or parasol and knitting case.
19	2540	Thomas Rutter	Harborne	Nail.
„	2541	Arthur Jerningham	Portsmouth, Commander in the Royal Navy	Letter clip.
„	2542	John Martindale and Thomas Bowman	Globe-road, Mile-end	Poche-au-chapeau.

CONTENTS OF THIS NUMBER.

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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1425.] SATURDAY, NOVEMBER 30, 1850. [Price 3d., Stamped, 4d.

Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. VARLEY AND HACKING'S COMPOUND CYLINDER STEAM ENGINE.

Fig. 1.

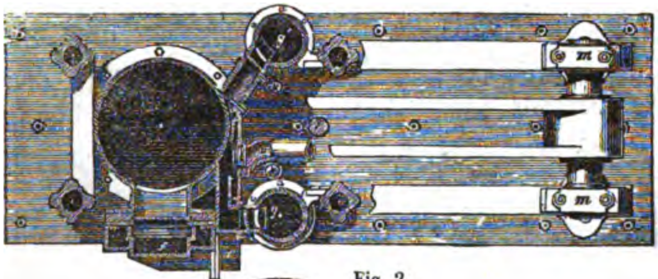
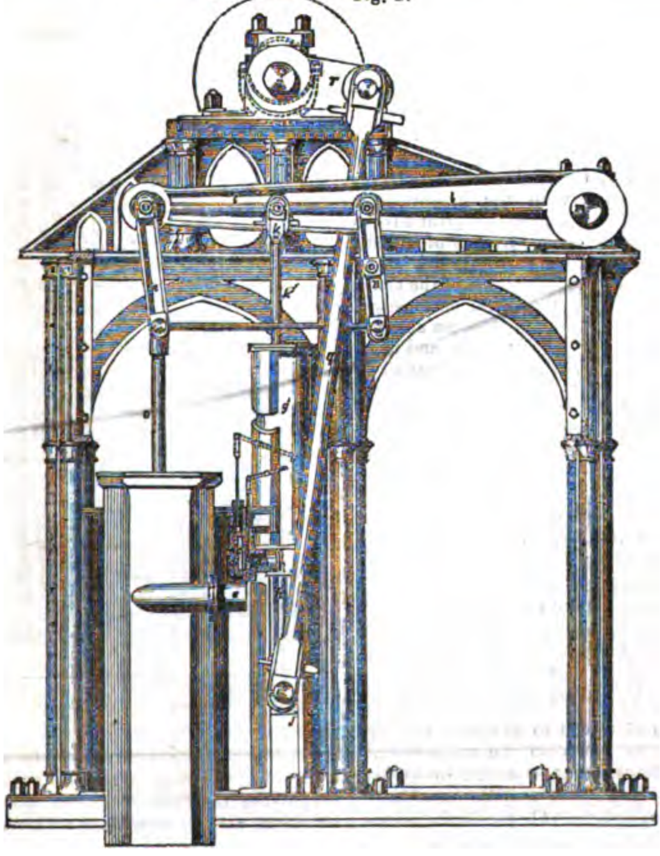


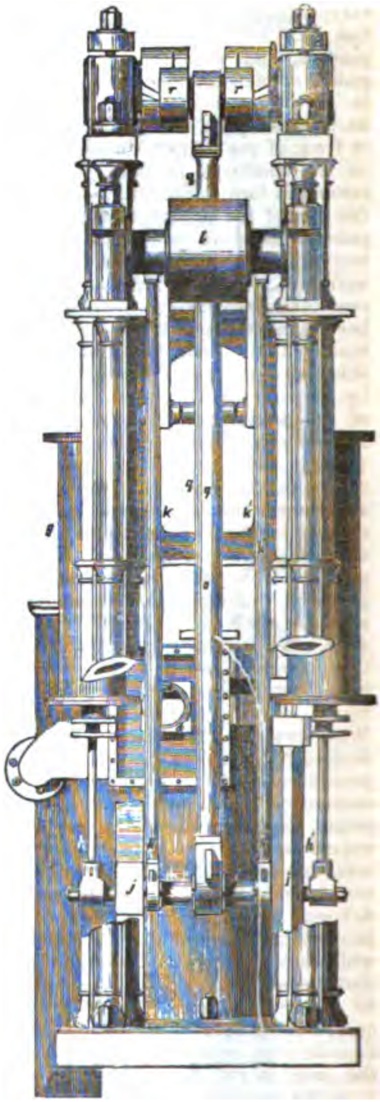
Fig. 2.



MESSRS. VARLEY AND HACKING'S COMPOUND CYLINDER STEAM-ENGINE.—(SEE *ante*, P. 255.)

Specification.

Fig. 3.



OUR compound cylinder engine consists of two inverted high-pressure cylinders, the piston-rods of which descend to a cross-head beneath. Two connecting rods are carried upwards from the cross-head to a lever similar to half of the beam of an ordinary engine. The outer end of this lever is also connected to a low-pressure piston. The combined power of the cylinders is imparted by a connecting-rod attached to the cross-head to a crank placed above the half beam or lever. This arrangement admits of the employment of a connecting-rod of almost unlimited length. Fig. 1 is a plan partly in section; fig. 2 a side elevation; and fig. 3 an end elevation of an engine constructed according to this improved arrangement. *a* is the steam pipe for supplying the high-pressure cylinders. *b* a cut-off valve to regulate the expansion; *c* a slide-valve which regulates the admission of steam to the ports or thoroughfares *dd'*. The port *d* communicates with the upper side of both of the high-pressure pistons and the port *d* with the under sides. After escaping from the high-pressure cylinders, the steam passes along the pipe *e* to the casing *f* of the low-pressure cylinder. Its admission to and exit from above and below the piston of the low-pressure engine may be regulated by valves, in the ordinary manner. The piston-rods, *h h'*, of the high-pressure cylinders, *g g'*, are connected to the cross-head *i*, which is fitted with guide-blocks *j j'*, working between corresponding guides in the framing. The connecting rods *k k'* are attached to the cross-heads *x*, and double lever *z*, having its fulcrum at *m* supported by the framing. The lever *l* is connected by the parallel motion *n* with the piston-rod *o* of the low-pressure engine.

The accumulated power of the three cylinders is transmitted from the cross-head *i* to the crank *r* by the connecting-rod *q*. The valves for regulating the admission of steam to the high and low-pressure cylinders are worked by suitable eccentrics or cams on the main-shaft. The air and other pumps may be worked by rods attached to the lever *l* or otherwise.

This arrangement may be modified by employing only one instead of two high-pressure cylinders. Or the high-pressure cylinders may be dispensed with, and the low-pressure cylinder only employed.

Much dissatisfaction has of late been manifest in regard to the management of public works. Where they have been carried on by Government according to the plans of its own officers, it is complained, and with some reason, that public opinion has not been consulted: as in the instance of the alterations in St. James's-park, and the intended wall in front of the British Museum: where, on the contrary, the public have been invited to furnish plans for a work, as in the case of the sewerage of the metropolis, individuals who have bestowed much thought and labour in compliance with that invitation, complain, and with reason also, that though their plans have been at least partially adopted, they remain without even the reward of an acknowledgment of the merit possessed by plans they had submitted. This state of things evidently calls for some new mode of procedure. Accordingly, various projects have been started—amongst others, that the department of the Woods and Forests should be bound to lay their devices before Parliament in the same manner as railway proposals are submitted. This mode has already been practised without beneficial result; the plans for the New Palace at Westminster were submitted to Parliament, but has this exempted the structure from real imperfection, secured the architect from blame, or satisfied the public mind? What remedy for such evils can be devised? Is it possible that some such procedure as Sir Samuel Bentham recommended, and habitually observed, might be advantageously adopted in regard to all public works? His idea was, that any public work being in contemplation, the plan for it should be devised, drawn, and described by the professional officer of the department to which it might more particularly relate—that the whole should then be referred to a variety of persons considered as competent judges of the matter under consideration, with a request or order, as the case might be, that observations upon the project itself, and the details of the plan, might be returned in *writing*—that should objections be made in consequence, or should improvements be suggested, they should be furnished to the professional officer, with orders to examine into and report upon the validity of those objections, and upon the eligibility of the improvements proposed, specifying in all instances the reasons on which the opinions he might give were grounded—that furnished with his reply, the department should then either institute further inquiry, or, if sufficient grounds on which to come to a decision should appear, an immediate determination on the subject should be made.

By an analogous mode of procedure, it is apparent that the labour in acquiring data and preliminary information would no longer fall, as now, on unpaid individuals who might feel disposed to give opinions, but upon the public officer; and having his specific plan to work upon, persons referred to, would be enabled to make their observations with but little expense of either time or money. The obtainment of data is said to have cost the originator of one of the plans sent to the Commissioners of Sewers no less a sum than 500*l.*

Mr. Frank Forster has been accused of plagiarism in his plan for the sewers of the part of the metropolis south of the Thames, principally on account of his having recommended the lifting the sewage by steam power, an expedient that had been before devised by more than one of the gentlemen who had sent plans to the Commissioners. Where the level of ground to be drained, or freed from sewage, lies below the level of an only practicable outfall, lifting the drainage or sewage by artificial means is so very obviously the only means of getting rid of it, that it could hardly fail to have occurred to any one who had given the subject a thought; still, as it had been proposed previously to Mr. Forster's appointment as engineer, it would have been but just to have prominently acknowledged the circumstance. Such grounds for complaint could not, however exist, were a first plan, as above proposed, to be in all cases formed by a professional officer; what he might delineate or describe would be thus authenticated as his own: where improvements might be made upon his design, the merit of them could not fail of being accorded to the devisers of them, and thus much bickering, heartburning, and ill-will would be avoided, whilst every

man would receive the share of merit due to him in contributing to the perfection of a work.

At the end of the last and early in this century, engineering, architectural, and mechanical science was confined to few individuals; now it is possessed by almost countless numbers, besides that it is more or less familiar to a great proportion of the British public; hence a material difference has arisen as to the persons to whom it formerly was, but now is, desirable that plans for public works should be referred. In works requisite for naval arsenals, for instance, almost the only persons competent half a century ago to form a sound judgment upon them were the several subordinate naval boards and the officers of royal dockyards; private shipbuilders had not then began to perceive the advantages of improved accommodation in building-yards, nor had private civil engineers turned their attention to the subject; it was, therefore, to the Naval Boards that the Admiralty referred Sir Samuel's plans for the improvement of our dockyards, and those subordinate Boards again referred them to the dockyard officers, though even then, in respect to plans of a superior interest, he caused his proposals to be printed and largely distributed for the purpose of obtaining opinions upon them. Now a very extensive dissemination of all proposals for public works seems essential—and this with a view as well to ascertain the expediency of them generally, as to perfect the particular plans that may be devised. Publication in periodical journals, and even in the daily papers, could nowise deteriorate a well-conceived design, whilst it might often lead to the contrivance of a superior one where that originally intended might be otherwise than satisfactory. We have now a case in point. Massive brick walls, and an enormous dome, subservient to the Exhibition of 1851, were canvassed and deprecated by the public, and made the subject of discussion in periodicals. This led Mr. Paxton—already familiar with immense erections of iron and glass—to conceive the idea of employing these materials for the intended structure. He designed his palace of glass; former plans were rejected by the very originators of them as soon as his was proposed, and it need not be added with what delight the public hailed the change. It is also from publicity given by the press to the unsightliness that would have been imparted to the British Museum by the erection of a brick wall to mask its front, that the erection of that brick wall is said to have been given up. The same press is clamorous against the alterations in St. James's-park, and to a certain extent successfully, for the filling up part of the ornamental water and other encroachments on the pleasure-ground have been abandoned; but would it not have been better from the first to have given the project publicity? Surely the public would have gloried in ameliorating the approach to their beloved sovereign's metropolitan residence; yet, at the same time, it might have been suggested that the purpose could have been effected, without cutting down trees that have been felled, and which constituted the chief ornament of the west entrance to the Birdcage-walk.

Some such mode as that proposed for public works seems applicable also to the minor erections that are in the province of county magistrates and overseers of the poor. These bodies now frequently offer premiums for the best design for some intended work. First-rate architects have rarely either time or inclination to compete for some 50*l.* or 100*l.*—the natural consequence is, that usually only inferiors in skill and taste respond to the call, and further assistance is sure to be essential. It is affirmed that, under this pretext, some favoured individual is furnished with all the projects sent in, that he culls from them whatever they may possess of merit, and thus is enabled to concoct a plan superior to any one of those that had competed for the premium. Might not for such works, some architect or builder be employed to form a first design? It might or it might not provide for the necessary requirements, but its cost would be but little, and publicity being given to it would, by diminishing labour to others, be likely to induce architects or engineers of superior talents to bestow their thoughts upon it, and thus contribute to the perfection of the design—the improvements upon which would be a subject for premiums, at once just to the deviser of ameliorations and beneficial to the party adopting them.

It may be objected to the mode above proposed that engineers, architects, and

mechanists of high standing in their professions might feel adverse to the submission of their designs to extensive criticism. On the contrary, supposing them to be unobjectionable, the originator of them could not but feel, as did Sir Samuel, desirous of courting investigation. Supposing, on the contrary, that real imperfections of a design were thus brought to light, it could not be otherwise than grateful to the feelings of an honourable man that defects should be made apparent at the outset, when easily remedied, than that costly and unsightly alterations should become requisite after a work was supposed to be completed, as has happened in the new chamber for the Commons at Westminster. It is, farther, as fair as it is reasonable to suppose that men of eminence in these professions feel a real interest in the perfection of their designs; so that, were the custom once established, suggestions of improvements would be thankfully accepted, and acted on with zeal.

A consciousness that designs would be so scrutinized would further have the beneficial effect of inducing extreme care in the formation of them, particularly as to subordinate details, now so frequently neglected, though so often influencing the more prominent features of a work in regard to their propriety. An early enumeration of the *desiderata* affords simple and easy means of keeping them in sight, and the best chance of their being all provided for.

Were publicity given to a statement of the reasons in favour of a work, together with a description of it, it would seem desirable that rules such as Sir Samuel laid down to himself for his own guidance should be uniformly observed;—amongst them, were the avoidance of professional phrases and technical terms wherever possible; the statement of facts in plain language, such as seemed most likely to be comprehended by the uninitiated; above all, not to distract the mind or pervert the judgment by oratorical embellishments, by vague assertions, or imposing epithets, so often offered and accepted in lieu of calculations and positive facts; hence there never appeared in his communications, though so frequently in those of others, that a work was "*necessary*," or "*invaluable*," "*for the good of the public service*," or that it was "*a national work*,"—phrases that have led to the disbursement, it may be affirmed, of millions of the public money without commensurate advantages of any nature.

M. S. B.

EXTENSION OF HORNER'S METHOD OF APPROXIMATION TO THE CASES OF UNREAL ROOTS OF EQUATIONS.

Sir,—You are aware that the subject of the numerical solution of equations is one of vast importance. In general, the only way of attaining this object is by means of approximation. The methods which have been devised by Messrs. Horner and Weddle for approximating to the *real* roots of equations are, perhaps, as complete and effective as the subject admits of. The methods hitherto devised, however, for approximating to the *unreal* roots are by no means so effective and satisfactory. In numerous instances, however, a knowledge of the *unreal* roots is very desirable—nay indispensable. My attention has lately been directed to this important subject, and I now beg to submit, with all deference, to your mathematical readers the following, as the result of my researches, which I designate "An Extension of Horner's Methods of Approximation to the Cases of *Unreal* Roots of Equations." No one, I believe, has ever entertained an idea of applying Horner's methods, except for approximating to the *real* roots of equations. It will be seen, however, from what follows, that his process is equally applicable in the cases of *unreal* roots.

I will now describe my method as explicitly and concisely as I can.

Let

$$x^n+ax^{n-1}+bx^{n-2}+cx^{n-3}+\ldots\ldots+m=0$$

denote any algebraical equation; then the unreal roots, as is well known, will be of the form of $f\pm g\sqrt{-1}$. Now before Horner's method can be applied in the case of *real* roots, it is indispensible that we know by some means or other the first figure of the required root; so likewise, if $r\pm s\sqrt{-1}$ denote a pair of *unreal* roots of an equation which we are in quest of, it will be absolutely necessary, before we can apply this

method, to know the initial digits of r and s. It is not my intention to discuss in this place the method of finding these initial values—that I shall leave to others who have more leisure time than I can command at present. My object is merely to show the extension of Horner's method.

Now suppose we know r' and s', the initial figures of r and s. Assume

$$x = y + r' + s'\sqrt{-1},$$

and substitute this for x in the given equation; it will then take the following form

$$y^n + (u + v\sqrt{-1})y^{n-1} + (u' + v'\sqrt{-1})y^{n-2} + (u'' + v''\sqrt{-1})y^{n-3} + \ldots + U + V\sqrt{-1} = 0.$$

Of course u, u', v, v', &c., may be either positive or negative.

Now I arrange these imaginary indices, and operate with them according to Horner's processes, the same as if they were real numbers, taking $r' + s'\sqrt{-1}$ for the first part of the root. The next correction of the root will be obtained by dividing the last divisor by the last but one, in the usual manner. It is scarcely necessary to remark of these binomial surds, that it will be necessary to first multiply both the divisor and dividend by the congeric surd of the divisor in order to render the divisor rational. The performance of this division will join $r'' + s''\sqrt{-1}$, the next part of the root. We may then repeat the process, which will give $r''' + s'''\sqrt{-1}$, the next corrections; and so on to any required degree of accuracy, the same as for real roots. I may remark that, although the process will necessarily be more tedious than in the case of real roots, yet it must be borne in mind that the operations determine a *pair* of roots, whereas in the case of real roots only, *one* is found at a time. As Horner's method is now so well known, it will not be necessary to take up room with giving examples; I shall therefore leave it in your hands.

I am, Sir, yours, &c.,
SAMUEL BILLS.

Hawton, near Newark-upon-Tyne,
Oct. 9, 1850.

PROGRESS OF ELECTRO-TELEGRAPHY—AND PRACTICABILITY OF SEA AND RIVER LINES OF COMMUNICATION.

[From Report by Examiner Page to the American Commissioner of Patents for 1849.]

A variety of inventions under this head, have been presented to the office, most of them based upon the electro-magnetic telegraph, or nearly related thereto. Prominent among these is the electro-chemical telegraph. Two patents have been granted for inventions of this kind, one of which has already gone into practical operation, to a considerable extent. These inventions were adjudged by the office to interfere with each other, and upon a hearing, priority of invention decided in favour of one of the parties. Upon appeal, however, to the usual tribunal, it was decided that the alleged interference did not exist, and patents were ordered to issue to both parties. The whole case was one of unusual interest, involving many intricate and important questions, and although the whole proceeding was prior to your accession to the office, yet the leading features are doubtless by this time familiar to you. The parties, Samuel F. B. Morse and Alexander Bain, came into the contest for priority of invention upon unequal grounds, the former being a citizen of the United States, and the latter a foreigner. It was held by your predecessor in office, that under the law a foreigner could not go behind his foreign patent or printed publication for evidence of his invention, and upon reference of this subject to the Attorney General, the opinion of the Commissioner was confirmed. It was also held, that in a contest for priority of invention, the sealing of a foreign patent was not to be taken as proof of invention, and that proof of enrolment was alone adequate. On the appeal to Chief Justice Cranch, the parties appeared by counsel, who occupied some days in elaborate and lengthy arguments. It was, I believe, the first trial of appeal from the office, had in open court, and the whole case has been faithfully reported and printed at the expense of one of the parties. The report will be read with much interest by inventors and professional men.

The operation of the electro-chemical telegraph depends upon the chemical reagency of the galvanic current. Marks or stains are made upon paper through which the galvanic current is made to pass, the paper being first saturated with some neutral or other salt, and moistened at the time to give it sufficient conducting power. The advantage claimed for this over the electro-magnetic telegraph, is that it may be worked

with much greater rapidity. In the electro-magnetic telegraph a signal is made by the development of electro-magnetism, and the consequent movement of a small bar of iron, both of which operations require appreciable time. In the chemical telegraph the production of the stains or marks is commensurate with the passage of any portion of the galvanic current; for, according to the best authorities, the current could not pass through the salt without decomposition. The change of colours, as indicated to the eye, may not be so sudden as the transit of the current, but if it should not be so in fact, it becomes so practically, as the marks are not required to be seen at the instant of decomposition. I am not informed upon this point, but it is immaterial; the practical distinction between the chemical and electro-magnetic telegraph being this, that as it requires time to change and discharge an electro-magnet, and also to overcome the inertia of moving parts, there must be a limit in practice to the rapidity of making signals, while in the electro-chemical telegraph, the limitation would depend upon other causes, and the rapidity of action would probably far exceed the ordinary mechanical facilities for communicating signals. With a view to avail himself of this greater capability of this telegraph over the above, one inventor has patented a means of preparing and transmitting communications much more rapidly than the ordinary manipulations with the key. To accomplish this, strips of paper are perforated by machinery, in such a manner that the perforations may correspond to the signs representing the latter, figures or words, and by means of these perforations and the intervening spaces, or whole portions of the paper, the circuit is broken and closed with as great rapidity as a slight spring pressing upon the strip of paper can be made to act. It is only necessary that the motion of the paper at the other end of the line which is to receive the communication should move with a corresponding rapidity. In practice it has been found that the rapidity of execution is much less than it should be theoretically; but, nevertheless, it is far greater than with the electro-magnetic telegraph. With this, as with all the plans for telegraphs hitherto undertaken, a difficulty of some importance has been encountered, from the imperfect insulation of the wires, although great pains have been taken to render the insulation as complete as practicable, and several patents have already been taken out for telegraphic insulators. As the insulated supports for the wires have to sustain a considerable weight, they must be made of considerable strength; and, moreover, as they have been made the sportive targets of lawless boys, and objects of less wanton though more malicious mutilation by mischievous men, it has been found necessary to give a due share of attention to strength and safety in this respect, and in so doing some sacrifice of insulating properties have been thus far deemed necessary. A curious result follows from this want of insulation. If it be assumed that the air is impervious to galvanic electricity, all that can return to its source between two distant stations, without travelling the whole distance, must pass down each post on the line, and can only reach the post through the substance of the insulating material employed, or along its surface in case it should be moist. A greater amount of electricity will pass down those posts nearest the station where the battery is in operation, and at the extreme end of the line only a feeble portion will pass through the instruments. The consequence of this has been, that upon the conductors being moistened upon their surfaces, the instruments at the distant stations would work with unequal power, and occasion much embarrassment. This difficulty is in some measure remedied, by having batteries at each end of the line, or at every station, although the defective insulation still exists for each. I am inclined to think, however, that the air, when loaded with moisture, is a conductor of galvanic as well as of mechanical electricity, as indicated by my experiments, several years since, with the immense copper roof of the Patent Office, forming a great galvanic plate of upwards of 20,000 square feet of surface. If it is sufficiently so to be of practical value, it is obvious that entire insulation of telegraphic wires will be difficult to accomplish.

The crossing of rivers and large bodies of water, by means of submerged wires, does not seem yet to have been attained, and the chief obstacle thus far is imperfection in the methods of insulation. The plan which I proposed several years since appears to be worthy of trial. It consists in using a local circuit and battery of quantity at each river or body of water. The galvanic current employed on the main routes are of small quantity and high intensity; hence a slight defect of insulation in a submerged wire would be productive of a great loss. But by using a current of quantity and the lowest possible intensity, to be set off by a local magnet, I am inclined to think that a single wire laid in the river with the most ordinary preparations for insulation, would be effectual in establishing connection between the terminations of the great line on opposite sides of the river or other body of water. It has long since been proposed to connect the eastern and western continents by means of

telegraphic wires laid down in the depths of the ocean, and lately the proposition has been revived with a venturesome and true American spirit. It does not appear in any way impracticable to stretch a wire from the American continent to England; and in the waveless depths of the interminable waters, the wire would be more secure from depredation than upon *terra firma*. From its weight, it would sink beneath the realms of the living monsters, and lie far out of reach from the ruthless hand of mischief or speculating avarice. But the insulation of such a wire is a thing not easily conceived of, in the present state of our knowledge. Besides the mechanical niceties required to obtain a complete insulating covering for the wire, we should have to contend against the corrosive action of the sea water, and this too, at a point where its greater density would exalt its chemical agency. Much has been expected and promised from gutta percha as an insulator, but we have not been long enough acquainted with this curious substance to test its value for this purpose. It is indeed a most excellent electric and insulator, but I have seen several instances of its decomposition when exposed to air and moisture, and some cases of its entire destruction when in thin sheets. I have been recently informed that the decay of thin sheets of gutta percha is attributed to caustic materials used in preparing it; however this may be, I have seen supports for telegraphic wires made from the pure gum, undergo in one season decomposition to such a depth as to form a bibulous mass upon its surface, and materially impair its non-conducting property. It resists, however, to a remarkable degree the action of strong acids, and may be used with great convenience for funnels, syphons, &c., for transferring and holding even strong nitric acid. It may not be out of place here to mention its unfitness, when in very thin sheets, for models of patented inventions. During the past year a patent was granted for a surgical instrument, an essential part of which was a sac of gutta percha. In the course of a few months the entire sac had disappeared, having crumbled into powder.

American Indicating Disc Telegraph.—An instrument under this name has been patented, which presented some ingenuity and novelty in the mechanical arrangements, and also in the selection and use of signals. It is an optical or indicating telegraph, as its name purports, and in this particular must yield to the recording telegraphs. The signs are indicated by the figures 0, 1, 2, 3, 4, these being the only symbols used. These stand for the vowels, and the remaining letters are represented by combinations of these figures. The figures are arranged in four sets, upon the face and near the circumference of a disc, which revolves by means of a novel internal escapement, which is moved by a lever attached to the armature of an electro-magnet. Its language is less complex than that of other indicating telegraphs.

Pen Telegraph.—When Professor Morse's telegraph was first essayed in this city, it recorded the signs upon a moving fillet of paper by means of a pen charged with ink, the pen being supplied from a reservoir or fountain. It was found difficult to regulate the flow of the ink, more especially as the motion of the pen was apt to *throw* the ink, as it was termed, and the pen was accordingly dispensed with, and a contrivance substituted, by which marks corresponding with those made by the pen were indented upon the fillet of paper. This required some mechanical force, and it became necessary to have a local registering magnet, as it is called, of some power to supply this force. In the new pen telegraph the inventor has ingeniously reversed the order of Morse's telegraph, and moves the paper to the pen, which is kept stationary, thus obviating the difficulty of throwing the ink and requiring a slighter force to move the paper than is now required to indent the paper. The pen is also fed by an ingenious contrivance. A lever or arm carrying a feeder which dips into a fountain of ink, is operated at the requisite intervals so as to move up to the pen and deposit upon a proper amount of ink, and then retire again to the fountain to recharge. This arm carrying the feeder is actuated by the clock-work which is used to move the fillet of paper. It was thought that this invention would save the necessity of using a receiving magnet, and that the telegraphing might be performed directly by the use of one magnet merely to move the paper to the pen. If, however, it fails to supersede the receiving magnet, it can have no advantage to recommend its use.

Painting Telegraph Wires.—A patent has been granted for a machine for painting telegraph wires, to preserve them from rust. The invention is notable not so much for intrinsic merit or novelty, but as marking the progress and rapid extension of the telegraph, by the introduction of labour-saving machinery, in the manufacturing departments of the art. Attempts have also been made to patent modes of insulating the wires, and of forming them into ropes of suitable size and strength; and although the telegraph might have, and in some cases, has been benefited by their use, yet they were not in the category of novel inventions, and could not be patented.

Mode of sustaining Telegraph Wires across Rivers —Many attempts have been made to improve this part of the telegraph system, and generally but little difficulty has been experienced, except where the wires and piers might become an obstruction to navigation. If the piers are very far apart, there is danger of the wires breaking under their own weight, and more especially when loaded with ice. The plan in question proposes to suspend the wire to a cord of India rubber, stretched to its greatest tension or nearly so, or what is better, to inclose the wire in a tube, which is to be stretched over the wire; this would save much swagging of the wire, and as the India rubber is a very strong material in proportion to its weight, the invention appears feasible, and is at least very ingenious. I have not heard of its use thus far.

I have been somewhat lengthy and discursive on the subject of telegraphs, from the magnitude and importance of the invention, and its growing interest with the public, who will be gratified to follow closely every step of its development. The past year has been unfruitful in discovery, and in striking inventions. Political economists might attribute it to the distracted affairs of Europe, whence science has been wont to emanate, and to the visitation of pestilence and gloomy forebodings at home. But it is remarkable, that the close of the past year, and the few past days of the present, have shown symptons of reviving energies in science, and its application to art, which will ring upon the year to come a cheering note of convalescence, and astound the public mind. Your examiners, and all engaged in the office, are interdicted from all communications, public or private, respecting unexamined and pending applications for letters patent. But I divulge nothing, and do no more than whet the keen edge of curiosity, by the prediction, that the coming year will be more fruitful than the past, both in discovery and invention. The world has never witnessed an invention so extraordinary in its conception and achievements, as the electric telegraph, carried to such a pitch of improvement and successful operation in so short a time; but the end is not yet, and we shall soon see new powers and modifications brought into play, and this mysterious yet simple, infantile yet seemingly matured invention, is to receive new accessions, and grow into capabilities far exceeding our present expectations.

IRON IN CONSTRUCTION.

Iron, by reason of its great strength, its durability, and the facility with which it can be converted into almost any shape, by casting or by the hammer, renders it a most important acquisition for construction of every kind. It has for many years past been successfully employed in steam engines, mill-work, civil engineering, and shipbuilding. It is only lately that architects have condescended to follow the example of the different professions here enumerated. Some excuse may be admitted for partial failings in the first applications of this material; but after the extensive practice now recorded of its application, and the numerous failures also recorded—and which serve as lessons to those who may now apply it to building purposes—any excuse for a failure is inadmissible.

In a late number, we ventured to express our apprehension of the inadequate strength of the building now erecting in Hyde-park for the Great Exhibition of 1851, because we have preferred thus to offer a timely and friendly admonition, rather than to have the painful duty of recording another inexcusable failure—a real national calamity—to the many already on our pages. What we have said as a forewarning concerning the Exhibition building, may with propriety be said of many buildings now in course of construction throughout the metropolis. We see huge masses of brickwork laid upon extremely slender supports of iron; and these *unseemly architectural features* are most prevalent at the angles of streets, where they are most exposed to receive a shock from a passing wagon, or a runaway carriage—accidents by no means unusual in the metropolis. The greater number of these pillars are so very disproportionate in the thickness compared with the height, that a comparatively small force or shock applied laterally would easily break those of cast iron, or bend those of wrought iron; and a small flexure in the one or the other, without the aid of a shock, would eventually bring the whole fabric to the ground. In either case, there may be quite sufficient quantity of iron to resist the pressure vertically,—it is the lateral strain that is most in danger of destroying the equilibrium: and we think it highly necessary that authorized surveyors (practised in iron work) should be appointed to exercise a judicious control over the constructions we have described. In an architectural point of view, these buildings shock common sense, in seeing a great surface of walling without any apparent support: whereas the same quantity of iron now employed could easily be made of such a form as to produce both sufficient strength and ornament.—*The Architect.*

MIDDLETON'S REGISTERED CENTRIPETAL WHEEL-PLATE.

(Messrs. W. and C. Middleton, of 40, Long Acre, Coach-builders, Proprietors.)

Fig. 1.

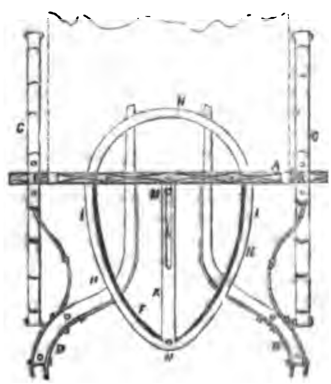
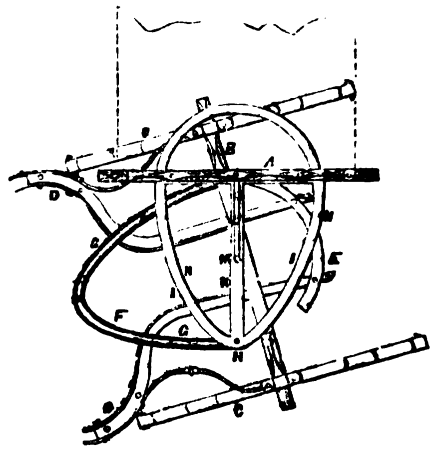


Fig. 3.



Figs. 1 and 2 are plans of the fore part of a carriage fitted with this wheel-plate. Fig. 1 shows its position when the front wheels are supposed to be moving in a straight line with the hind wheels; fig. 2 shows the position of the same parts when the carriage is on the lock. A A is the top bed, B B the lower bed-plate, C C the front springs, D D the futchells, and E the hind felloe piece; F is the transom plate, which is of a semi-elliptical form, having a groove or slot G G cut in it. H is the wheel-plate, the front part of which I I is also of a semi-elliptical form, and corresponds in shape and size to the transom plate. The hinder part of the wheel plate is represented as being circular, as usual, but may be of any form. K is a bar, which forms the conjugate axis of the wheel plate, and has a slot L in it, into which the centre bolt M slides. N is a pin affixed to the end of the conjugate axis bar K, the lower end of which pin takes into the slot G G.

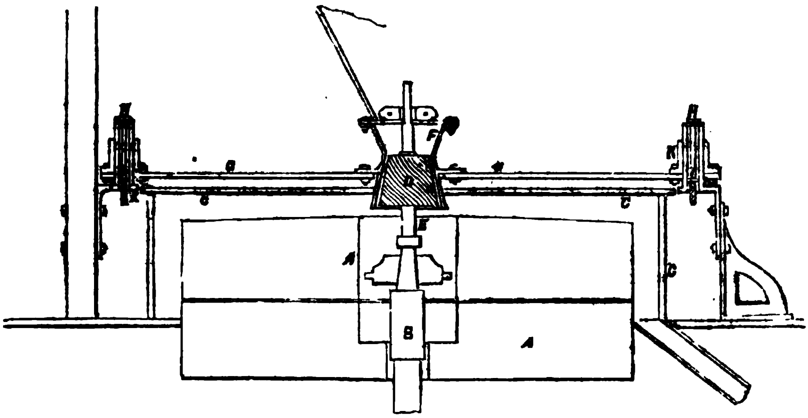
The utility of this design consists in making the carriage shorter between the hind and front wheels, and thereby lessening the draught, which is effected by means of the elliptical form given to the wheel and transom plate, in conjunction with the slot L in the bar K, which causes the under front carriage to move forward when on the lock, but still retains it in its central position under the body.

CHAPMAN'S REGISTERED GRAIN CRUSHER AND FEED REGULATOR.

(Mr. William Chapman, of Johnson-street, Clonmel, Tipperary, Inventor and Proprietor.)

The engraving exhibits a vertical section of a pair of millstones fitted with this crushing feed apparatus. A A are the stones; B the mill spindle; C the case; D a conical crusher, which occupies a position at the bottom of the feed spout or hopper, and directly over the eye of the runner. It is mounted upon the "damsel" E, and partakes of the movement of the mill spindle B. The conical surface of the crusher is beaded or waved, between which and the hollow cone or case F the grain is bruised as it is being fed into the eye of the stone; G is a bridge, by which the case F and the upper bearing of the damsel are secured. H H are screws by which the bridge and case are adjusted in reference to the crushing cone. These screws work in nuts I I placed inside of the sockets K K.

The advantages of this form of feed



apparatus are, that the grain is bruised previous to entering between the stones, the feed is regular and proportionate to the velocity of the stone, and the work is greatly facilitated.

PROVISIONAL REGISTRATION.

A great outcry has been recently raised against our Patent Laws, because they will not allow people to make their inventions public without forfeiting their right to patent them Essentially this amounts to affirming what has heretofore been considered as one of the most unreasonable of all unreasonable things, namely, that one may have his cake and eat it too; for the principle on which all grants, or of patents, are founded—not in this country alone, but throughout the civilised world—is that where a party is in possession of a secret in art or manufacture, by which the good of the community to which he belongs may be promoted, it is good policy in that community to get the secret out of him by granting him a temporary monopoly of its "use and exercise" for a limited period. No secret—no patent. The notion of there being any natural right of property in inventions has been long ignored by all sound publicists. Right, in this case, there is none beyond what society for its own sake confers—and whether the monopoly should be for seven, fourteen, twenty one, or any other limited number of years, depends simply on a calculation of the average amount of bounty, necessary, to induce people to invent all they can, and publish all they know.

Let us see, however, how the supposed hardship of the existing state of things is proposed to be remedied. Mr. Recorder Hill proposes in his letter to the Mayor of Birmingham, which we published last week, the establishment of some "permanent institution, in the nature of an inventor's mart," where a person may place an invention, and "be in the same state as regards a patent right as if he had previously sued out his patent; subject, however, to the condition that the patent shall be sued out within some reasonable and specified time, or not at all." Very similar to this is the "Proposal"* of Mr. D. S. Brown ("first made," he says, to the Board of Trade in 1845,) that "every one shall be allowed to register his invention immediately upon depositing a description of it in an office to be established for that purpose; and by so doing, to obtain a priority of claim to take out a patent for the same within a limited period afterwards; the invention, in case he should neglect to do so, to become public property."

One very palpable objection to both these plans, and to all plans of the like sort is, that, though we might bind our own citizens to respect such provisional registrations, we could not bind the citi-

* "Proposal for a Provisional Registry of Inventions, with a View to obtaining Letters Patent for the Same," By D. S. Brown. 8pp., 8vo. Nissen and Parker. London, 1850.

zens of any other country. No British subject could steal a provisionally registered invention, but any foreigner might. The whole British public would be tied up for the period of the provisional protection from turning the registered invention to account, while the people of every other country would be free to make instant use of it, and be so enabled to gain the start of us in the race of industry by all the time allowed (say six or twelve months) for suing out a patent. An inventor might, it is true, secure patents in foreign countries previous to the provisional registration at home; but unless you were to *bind* him to do so—which you would certainly never think of doing—foreign spoliation to a large extent could not possibly be prevented. A storehouse which all but ourselves were free to pillage, would never at the end of any year have a single thing left in it, unappropriated by some alien adventurer or other.

Again; supposing there were no such insuperable difficulty in the way—that inventions could be equally protected by provisional registration from foreign as from native piracy—of what sort is the protection to be? "Exhibit the invention," says Mr. Hill—place it in some public exhibition, like that which is about to take place in Hyde Park. But there are many inventions which no exhibition can give any idea of—processes, for example, the merit of which consists in some saving of time, or labour, or material. Then "deposit a description in an office," says Mr. Brown. But what kind of description? From what he says about an inventor being under the necessity of having "time for maturing his invention," and for "making experiments to test its efficacy;" it is clear that he contemplates some general announcement, wholly free from specific details. But only see to what inconveniences such a mode of procedure would lead. People complain much now, and with reason, of "blind titles"—blind, because expressed in such vague and general terms that they may be made to comprehend almost anything; but what would the evil from that source be compared with what might be expected from blind specifications? If an inventor were at liberty to specify only as much as would suffice to *ground a claim upon*, it would thenceforth be the study of intending patentees to be as indefinite as possible in their descriptions, of which indefiniteness the sure result would be endless contention and litigation.

No: provisional registration and provisional specification are equally inadmissible. The patent right should be completed at once (the existing obstacles thereto being cleared away), and so also the disclosure or specification, which is the foundation of the right, should be at once complete, under pain of forfeiture of the right.

SCIENTIFIC BIBLIOGRAPHY.

Sir,—The very interesting and instructive series of papers which have appeared in your Journal from the pen of Mr. Wilkinson, under the head of "Mathematical Periodicals," have tempted me to try my hand at a similar collection touching the Arts and Sciences in general. I send you, by way of specimen, a batch of extracts from the Catalogue *raisonné* of Messrs. Shortman and Co., and if you like them, shall send you more from time to time, as leisure may allow.

I am, Sir, yours, &c.,

DIBDIN REDIVIVUS.

London, Nov. 15, 1850.

P.S. I prefix to each work the Nos. in the original Catalogue, for the sake of intending purchasers.

PART I.

73. MAYORALTY MUMMERIES MODERNIZED; OR, ANCIENT PAGEANTRY ADAPTED TO EXHIBITION YEAR. By BADWIN. With Numerous Plates, including

Gog (in the character of Momus) mounted on an ass, with new cap and bells.

Magog (as Bacchus) astride a puncheon drawn by four hogs in armour.

Prince Good Intent on the Wooden Horse of Troy.

Achilles (as the Foreigner) in his War Chariot.

Hector (Native Industry) in the dust.

A Noble Lord as Cassandra.

Britannia, in mourning, reposing on a sleeping lion, with mane clipped and nails pared.

Crown folio, 1*l*. 15*s*. *London*. 1850.

130. PLANETS AND PANCAKES; or, the Copernican System Exploded. By FATHER CULLEN.

Fine old calf, with iron clasps, 20*s*. *Dublin*. 1849.

660. ITALIAN BLINDS: Pattern Book of the Vatican Manufactory. Containing upwards of 1000 different designs adapted to English use. Plates by PUGIN. Letter-press by WISEMAN.

Folio, bound in purple and gilt, 3*l.* 3*s.* *Rome.* 1850.

740. THE ELECTRIC LIGHT. New Edition by ALLAM.

An exact reprint of the *original copyright work* by Staite and Petrie, but with new Title, and Engraving of the Allam BRASS battery.

Presentation Copy of the Protection of Trade Society. 2*d.* *London.* 1850.

860. MEMOIRS OF THE THREE TAILORS OF TOOLEY-STREET. With Fac-simile of the Original Declaration of "We, the People of England."

Published under the Superintendence of the Patent Law Reform League.

8vo, calf, 2*s.* 6*d.* 1850.

913. STATISTICS OF SOAP: Showing the annual cost to populations of 1000 and upwards of a clean shirt once a day, once a week, and once a month; also the annual savings within the Bills of Mortality from the adoption of black stocks and caoutchouc nursing aprons; also the quantities of soap annually wasted by the use of hard water, and how they exceed the entire quantities consumed; also the number of soap bubbles that go to the blowing of a WATER BUBBLE. By Professor DUFAIR.

Curious and rare, 50*s.* *Westminster.* 1850.

Only one other copy of this work is known to exist, which is in the Library of the Board of Health,—the remainder of the impression supposed to have been bought up and suppressed.

1110. HYDRAULIA CURIOSA: Gleaned in a Scamper from Gwydir House to Farnham. By the Hon. W. Napier. Parts I., II., and III. (all yet published.)

Part I.—The Drop from the Clouds.
II.—The Drop too Much.
III.—The Drop (of Humpty Dumpty) from the Wall.

Blue covers, 5*s.* *London.* 1850.

A correspondent of the *Notes and Queries*, No. 5050, asks—"Is this the Napier who invented the Logarithms?" Dr. Trewasdeth makes for answer, in the following Number—"Yes; and the same who set the Thames on fire."

Here Ends Part I.

PATENT CASE.—IMPORTANT CASE OF SCIRE FACIAS.

COURT OF COMMON PLEAS.—Nov. 18, 1850.

[*Before Lord Chief Justice Jervis, and Justices Maule, Williams, and Talfourd.*]

THE QUEEN *v.* MILL.

This was a *scire facias* to repeal a patent obtained by the defendant for "Improvements in instruments used for writing and marking, and in the construction of inkstands." At a trial before Lord Chief Justice Wilde it appeared that the invention patented consisted of eleven parts; but that the novelty of the sixth part, which was "a notched or serrated pen-holder," and of three other parts, was contested by the prosecutor. A writ of *scire facias* to repeal the patent was accordingly issued on the 10th December, 1849; the defendant pleaded issuably in Hilary term, 1850, and on the 23d April, after issue had been joined, entered a disclaimer of the parts in question under the statute 5th and 6th Wm. IV., c. 83, which provides that any person having obtained letters patent for any invention may enter a disclaimer of any part of his specification or memorandum of any alteration therein, which, when filed, shall be deemed part of such specification. The matter was thereupon resolved into a question of the legal effect of a disclaimer made under the circumstances mentioned, and at the trial a nominal verdict was entered for the prosecutor, and leave reserved to the defendant to move to enter the verdict for himself if the court should be of opinion that the disclaimer in this case, notwithstanding that it was made after issue joined, must be taken to be part of the specification.

A rule having been obtained,

Mr. Butt, Q.C., and Mr. Webster were now heard against the rule, and relied principally on the authority of the case of "Perry and others *v.* Skinner," 2 Meeson and Welsby's Reports, 471, in which the Court of Exchequer decided that where a patent is originally void, but is amended under the statute 5th and 6th Wm. IV., c. 83 by filing a disclaimer of part of the invention, that Act has not a retrospective operation so as to make a party liable for an infringement of the patent prior to the time of entering such "disclaimer;" and in which case Mr. Baron Parke, in giving judgment, said, "If the opposite construction were adopted it would lead to manifest injustice. That this was an effect the law would not give to any Act of Parliament unless the words were manifest and plain; and that the court would therefore engraft a modification upon the words of the Act for

the purpose of construction, and read it as though it had been 'shall be deemed and taken as part of the said letters patent, &c., *from thenceforth*,' so as not to make the defendant a wrong doer by relation."

Mr. M. Smith having been heard in support of the rule,

The Lord Chief Justice said: I am of opinion that this rule should be made absolute. Two principal questions arise in the case; first, what is the proper construction to be put on the statute 5th and 6th Wm. IV., c. 83; and secondly, whether the specification as amended by the disclaimer is admissible on these pleadings? If it had not been for the case of Perry and others *v.* Skinner, I confess I should have thought, upon reading the terms of the Act of Parliament, it was quite plain and clear that the intention of the Legislature was to allow a specification on which a doubt was entertained to be amended, pending an action, after proper precautions had been taken by the law officers of the Crown, and such terms had been imposed as they in their discretion should think fit, and that when such disclaimer was perfected, that it should be deemed and taken to be part of the specification. Unless that be the real meaning of the Act of Parliament, it seems to me that the proviso, which says "that no disclaimer shall be receivable in evidence in any action or suit (save and except in any proceeding by *scire facias*) pending at the time when such disclaimer was enrolled," would be totally inoperative; for if the construction contended for "Perry *v.* Skinner" is to be the construction under all circumstances, and as the disclaimer is to date only "thenceforth," that is from the date of the enrolment, the proviso would be useless which says that it shall not be receivable in evidence. I confess, therefore, that I think this disclaimer must be read as part of the specification at the time the patent was granted, and in this view it is the specification which must state what is old or new by express words or implication. The matter, therefore, runs thus: Here is a patent for three things, and on this eleven claims are founded. But some of the claims are not entirely new in themselves, though they are new in combination with the rest; and, reading the disclaimer with the specification, it will be seen that no right is claimed in respect of them, but only in respect of the remaining parts of the patent. But it is said if this is so, and the disclaimer is to be read as part of the patent, it is void because the patent is for three things, and the specification is only for two, so that the patentee has not complied with the conditions of the patent. It may be doubtful, however, whether in truth the disclaimer, when properly read, is a disclaimer of the specification only. The Act of Parliament rather adverts to this, for it speaks of a disclaimer in the title, or the specification, and in treating of the specification itself it adverts to the failure of the patent by reason of the specification. But if that is so or not, it is clear the specification complies with the title. The specification is for instruments in writing by pens and pencils, for marking by pens and pencils, and for the construction of inkstands. But it is said, you do not mark by means of pens and pencils, and you do not show by your specification what your instruments for marking are. But if I am right in my reading, there are certain things described in the specification, some of which are new, and some of which, being old, are disclaimed; and therefore, the specification is as large as the patent or the title, and satisfies the condition of the patent by describing the entire invention. If the patent may be read in this way, the only question is as to the admissibility of this plea. If the specification be part and parcel of the record, the plain issue raised by the objection must be tried by the specification; but I think it is a mistake to say that it is part of the record. I think it is rather like the particulars of the plaintiff's demand, or for the purpose of giving special notice to the defendant what he has to meet at the trial. Then what are the issues. The *scire facias* sets out the patent, but not the specification. If the defendant pleaded *non concessit* he would be beaten on the construction of the patent, because the patent in terms is set out. Now, what is the question to be tried? The patent is set out, but what is meant by it cannot be ascertained till the specification is set out. Then if the prosecutor reads part, and says "You claim this as new?" the defendant says, "No, read on; you will find that I describe that as old by my disclaimer." On these grounds, I regret to say, I think we are bound to question (though we only do so indirectly) the decision in Perry *v.* Skinner, and to say that this rule should be made absolute.

Mr. Justice Maule: I also think that this rule should be made absolute. I think there are three main questions—the first, on the construction of the statute; the second, whether a disclaimer, supposing it to be receivable in evidence, is admissible respecting an issue joined before it had been made; and the third, whether the specification, as amended by the disclaimers, is a specification sufficiently describing the invention according to the title of the patent. With respect to the construction of the statute, the words seem very clear, and so they were considered in Perry *v.* Skinner, for in that case they were considered as obscure only as respected the particular interpretation

which the Court of Exchequer then adopted. But I think, when the language of the statute is carefully considered, that the inconvenience that court apprehended from it will not arise. The statute gives, not an absolute power to any party to enter a disclaimer, but power to appeal to the discretion of the Attorney-General, who may grant or refuse leave to enter such a disclaimer, as he, acting judicially on behalf of the public, shall deem best for the public interest. With respect, therefore, to the many inconveniences suggested, this provision must be taken as providing means for preventing any such inconveniences by the Attorney-General's refusing, or only provisionally granting power to the patentee to disclaim. Then that power being given, the statute proposes a further limitation as far as individuals are concerned :—

"That any person may enter a caveat in like manner as caveats are now used to be entered against such disclaimer or alteration, which caveat being so entered, shall give the party entering the same a right to have notice of the application being heard." Therefore it does not say that the disclaimer being entered, shall be part of the specification, but only that when admitted by the Attorney-General and enrolled, it shall be deemed and taken to be part of it. This being so, I think we are bound by the Act of Parliament to deem and take the disclaimer to be part of the specification, though it is enrolled subsequently; and that this is the true construction of the statute is, I think, proved by the words which follow, viz., "That no such disclaimer shall be receivable as evidence, in any action or suit pending at the time when such disclaimer was enrolled; but in every such action or suit the original title or specific tion alone shall be given in evidence, and deemed and taken to be the title and specification of the invention for which the letters patent have been or shall be granted." Now, if there were any doubt as to the construction of the former words, I think this clears it up, for this shows manifestly that, with respect to the alternative not provided for, viz., when the disclaimer is not pending an action or suit, that then that shall not happen which, but for the proviso, would have happened with respect to pending suits. And the latter portion of the proviso was necessary in the case to which it applies, for, but for this proviso, not the original title and specification, but the amended title and specification would be deemed and taken to be the title and specification of the invention for which the letters patent had been granted. Then, if this is the literal sense of the section, let us consider the question whether we are obliged to put a different construction upon it. A *scire facias* is where a person takes upon himself the part of a public prosecutor and to question the validity of a patent. Now, the patent impugned may be of some meritorious invention, on the legality of which disputes arise upon the strict construction of the provisions of the patent laws, and it was to meet such a case and to enable such a patentee to evade the strictness of the law that this statute was passed. When, therefore, a person comes forward on behalf of the public, and brings a *scire facias*, supposing the patent is for some useful invention, such as this is admitted to be, but which, besides claiming some things as new and useful, also claims some other things which have been discovered before, it seems to me that such a case is a meritorious case within the Act, and that such a person is a fit person to be protected. And you will observe that but for the bond given by the defendant, the prosecutor, as soon as the disclaimer takes place, would have all he asks. He does not say that the patent is null and void to all intents and purposes, but that the patent was to be taken subject to this law, and then, as soon as the disclaimer takes place, everything which the prosecutor ought to wish for the benefit of the public is done, and instead of a patent's being a bad patent, which is a bad thing, it is a good patent, which is a good thing; and as he says his object is only to get a bad patent cancelled, so far as such a patent is concerned he has got all he wishes for, except, perhaps, that which arises with respect to this bond about costs. Now this appears to be a matter in the discretion of the Master of the Rolls or the Attorney-General; but I do not see that with respect to a *scire facias*, or with respect to an action, that injustice would arise which has been suggested by the Court of Exchequer. The principle of this enactment seems to me to be this—when there is some matter which the Attorney-General in his judgment shall consider to be such a matter as may properly be amended, in such a case the patent shall not be avoided, but shall be amended. The spirit of the Act is, that small and insignificant objections to a portion only of a meritorious patent shall not prevail, but that in such cases amendments may be made. But the effect of this provision would have been lost but for the proviso that, for the infringement of a patent, bad only in respect of some trifling matter, an amendment may be made pending the action. Then the only question is as respects costs, and with respect to them the law sometimes does not take that care which the parties or their advisers are supposed to do; and in the present case the costs are not part of the judgment of the Court. If they are

to be got at all, it can only be by means of a proceeding which I conceive the defendant in the present case is not able to take, not in so far as it would not be just for him to take it, but in so far as it would be just, it may be that a a certain portion of the costs would be justly recoverable. For these reasons I think the rule should be made absolute.

Williams, J.—The words seem to be very clear and unambiguous, and we must follow what the Legislature bid us to do. It is admitted the patent cannot be cancelled; as soon therefore as the prosecutor had notice of this disclaimer, all further costs were useless; he ought to have put a stop to all further proceedings, and to give notice to the defendant to that effect; and if he had done so, he would not have probably had to pay costs under the bond.

Maule, J.—I think if it was necessary to put in the specification the disclaimer is evidence also.—Talfourd, J.—Concurred.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING NOVEMBER 28, 1850.

William Edward Newton, of Chancery-lane, civil engineer. *For improvements in warming and ventilating buildings.* (A communication.) Patent dated May 22, 1850.

The present patent is based on a patent of a similar nature granted to Mr. Newton—also founded on "a communication from abroad," June 5, 1849.

The specification of this patent opens with descriptions of the improved methods of warming and ventilating, in which stoves are employed, the fire-places of which are composed of metal, partially lined with brick, so as to diminish their capacity without affecting their radiating surface. It is now proposed to surround a stove of this description with plates, so as to leave a space which communicates with the bottom of the room through a passage fitted with a piston for closing or opening it at pleasure. A bent or "syphon" pipe leads from the upper part of the room to the enclosed space, which again communicates with the chimney by a pipe bent downwards to prevent soot entering it. Supposing now air to be admitted at the lower opening, it would be heated, and owing to its rarefied state ascend through the syphon into the upper portion of the room. Should the atmosphere of the room, however, become oppressively heated by closing the lower passage, the air in the syphon would be rarefied, and the vitiated air descend the pipe and issue into the chimney. Sufficient air would be admitted into the room through the openings in the door and window to supply the place of that thus carried off.

The syphon pipe may, it is said, be adapted to stoves and fire-places without the enclosed space. In this case it is furnished with a valve, which, when open, causes the vitiated air to be drawn off from the upper portion of the room, and induces ventilation.

Mr. Newton lastly specifies an improved arrangement with reference to the stoves included in his former patent, by which they are rendered available for culinary and domestic purposes. This consists in removing the wire gauze door of the stove, and placing an oven or boiler in front of the fire. The flue is also flattened and provided with apertures to receive kettles or saucepans.

Claims. — 1. Warming and ventilating rooms or chambers by means of a tube or pipe, one end of which communicates with the atmosphere of the upper portion of the apartment, while the other terminates in a closed air chamber contiguous to the fireplace, and by means of which heated air may be passed to that part of the room, or the hot and vitiated air drawn off and passed up the chimney.

2. The employment in the manner described, or any mere modification thereof, of a syphon tube or pipe, one end of which communicates with the upper portion of the apartment, while the other terminates in the exit portion or chimney of the stove or fireplace.

3. The construction and arrangement of these improved stoves, whereby they may be rendered available for culinary and domestic purposes, as well as for warming and ventilating.

Henry Columbus Hurry, of Manchester, civil engineer. *For certain improvements in the method of lubricating machinery.* Patent dated May 22, 1850.

The nature of these improvements will be gathered from the claims, which are as follows:—

1. Lubricating the working parts of engines which are packed in order to prevent the passage of steam, air, gas, water, or other fluid, by means of a bush or collar inserted in the packing, and connected with a reservoir for containing the lubricating material.

2. Forming a reservoir for lubricating materials in the moving parts of engines. A reservoir in the piston (for instance) is supplied from an oil cup in the cylinder cover, while the piston is kept at the top of its stroke.

3. Lubricating metallic pistons by means of a groove or grooves, a hole or holes in connection with an oil reservoir.—In some cases the piston-rod has a hole drilled lengthwise in it which serves to supply the lubricating material. The grooves may be

either spiral or parallel, in which latter case, however, care must be taken to have two packing rings on each side of the lubricating groove, so as to break joint between it and the extremity of the piston.

4. Lubricating axles of carriages, or revolving shafts, by means of a reservoir formed in the revolving part of such axle or shaft.

WILLIAM PALMER, of 14, Cottage Grove, Bow-road, Middlesex, gentleman. *For improvements in the manufacture of candles and candlewicks, and in the machinery applicable to such matters.* Patent dated May 22, 1850.

Mr. Palmer's present improvements in "candles" consist in employing wicks which have been deprived of their moisture, and at the same time saturated by immersing them in melted tallow, candle-stuff, or oil heated to about 300° or 350°. Fahr.

The first improvement in "candlewicks" consists in giving to the wick a set which shall ensure its turning out of the flame of a candle while burning. This is best done by twisting it spirally round a roller about an inch in diameter, and then dipping it whilst on the roller into melted tallow, as above described. The wick preserves its set when pulled straight either before or after cooling.

A second improvement consists in twisting two wicks in opposite directions round rollers, then drawing them off and passing them through hot tallow as before, by which a double wick is formed—each part having a tendency to turn out of the flame while burning.

A third improvement is the employment of looped wicks immersed in hot tallow. The patentee does not, however, claim the manufacture of looped wicks as they have been and are now ordinarily made.

An apparatus is next described suitable for twisting wicks. This consists of a rod eighteen inches long, revolving by means of bevel wheels within a fixed spiral of the same length. A wick is laid round the rod, passing between each coil of the helix, and the whole dipped into hot tallow. Then, by causing the rod to revolve, the wick is delivered at one end at the same rate of speed as it is fed in at the other.

Claims.—1. The improvements in the manufacture of candles.

2. The improvements in the manufacture of wicks.

3. The improvements in the apparatus for manufacturing wicks.

ROBERT COTGREAVE, of Eccleston, Chester, farmer. *For certain improvements in machinery or apparatus to be used in draining land.* Patent dated May 22, 1850.

Claims.—1. In forming drains or trenches, the employment of an inclined plane for conveying the severed soil to the surface of the ground, in combination with an adjustable flat guide, with or without rollers, acting as a regulator for the depth of cut, and also the employment of spiked rollers and a travelling band of cloth, for the purpose of assisting the severed soil in its passage up the inclined plane.

2. The use of a machine (similar to a harrow) provided with "tines," spikes, or scrapers, so arranged as to draw the displaced soil towards its centre, and fill the drain furrows after the pipes have been laid in them.

3. The combination of a flat surface guide with a coulter or cutter for turning the subsoil to facilitate drainage.

4. The general arrangement and combination of parts constituting the said improved machines.

SIMON PINCOFFS, of Manchester, merchant. *For certain improvements in the dyeing process in calico printing and dyeing, which improvements are also applicable to other processes in printing and dyeing.* Patent dated May 23, 1850.

In commencing his specification, Mr. Pincoffs observes that the ageing or oxidizing process has been hitherto performed by exposing the dyed and printed fabrics to the action of the air, generally without, but in some cases, with artificial means for hastening the operation. In the former case, the process is necessarily as variable in its effects as the weather itself—while in the latter, owing to either an excessive or insufficient supply of heat and moisture, the effects produced are equally uncertain.

Now with regard to this ageing process, the improvement proposed is—to construct under the ageing room a compartment or chamber about twelve feet square, supplied with an entrance door, and having in its sides near the floor, flaps for the admission of air, and communicating with the ageing room above, by forming the floor of the latter immediately over the regulating chamber of lattice-work; within this chamber is to be placed a wooden or iron vessel of about four to ten feet diameter, and three or four feet deep, furnished with an overflow pipe at about a foot from the top. The ageing room itself, if slated, must have the inside of the roof lined with wood or felt, and be supplied with ventilating chimneys. Before commencing the operation of ageing, the printed cloth is to be hung in all parts of the room except immediately over the regulating chamber, and the temperature of the room raised by steam or otherwise to about 78° Fahr. Steam is then admitted through a pipe closed at its emission end, but perforated with numerous holes, to the

iron vessel, previously filled with cold water until the temperature rises to about 185° Fahr. On opening the flaps, the admitted air will rise into the ageing room in a heated and moistened state.

The temperature most desirable to be maintained in this room has been previously stated to be about 78° Fahr. This may be tested by an ordinary hygrometer, but with greater facility and accuracy by placing the bulb of a thermometer in a gilt or polished brass cup about the size of a drinking tumbler, containing boiling water. If on pouring in cold water, condensation of the moisture in the atmosphere of the ageing room takes place before the temperature is reduced to 68° Fahr., then more cold air must be admitted; but should the temperature of the brass cup be lowered still more before condensation ensues, then the heat of the ageing room must be raised until the "dew" or condensing point is at 68° Fahr.

In order to collect the acetic acid displaced in the ageing process, Mr. Pincoffs employs troughs or perforated tubes attached to the ceiling of the room. These troughs meet in one common centre, where a fan or blower, worked by hand or power, condenses the acid, and further by acting as a ventilator, materially assists the dyeing process, which under this new system occupies only two days and nights, whereas formerly five days and nights was about the minimum. In some cases the acetic acid may be collected by means of a base or substances capable of combining with it.

Claims.—The introduction of heated and moistened air into the ageing room or rooms, and also the method described of ascertaining and regulating the "dew" point in a speedy and effectual manner.

2. Collecting the acetic acid either by condensation or by combining it with a base or with some matter or substance capable of entering into combination with it.

JULES FREDERIC MAILLARD DUMESTE, of Paris. *For certain improvements in reflectors for luminaries.* Patent dated May 22, 1850.

M. Dumeste's improved reflectors are designed to obviate the shadow usually thrown by reflectors, and to multiply the effects of light.

They may be applied to ordinary gas or other burners, by constructing the burners with a rim or projection round their lower end. This rim serves to support a collar, on which again rests a second collar, with three arms, one of which is lengthened, and carries a vertical standard of the height of the chimney glass. The reflector, composed of corrugated glass, is placed on the upper collar, the standard passing through a hole cut in it for the purpose. Above the reflector is placed the chimney glass, which is maintained as a fixture by means of a stay screw at the upper end of the vertical rod. The glass chimney may be either wholly or partially fluted or corrugated, and that either externally or both internally and externally.

Claims.—1. The application of a corrugated glass socket or reflector to gas-burners, as a support for the glass chimney, and their employment in conjunction, for the purpose of multiplying the effects of light.

2. The above-described method of maintaining the glass chimney in a vertical position.

JOHN HICKMAN, of Walsall, Stafford, clerk. *For improvements in the manufacture of cylindrical and other tubes.* Patent dated May 25, 1850.

The present improvements are specially adapted to the manufacture of such drawn tubes of soft metal as are required to be of a conical form. The metal, after having been soldered on a mandril, is passed through a coil of wire, by which the tube is exactly fitted to the mandril. Fluted tubes are made by soldering the metal on a fluted or grooved mandril, then placing rods of metal exactly over each groove, and passing the whole either through a soft metal die, by which the rods are forced into their respective recesses, or by means of a coil of wire, as in the first operation. The patentee disclaims the employment of a soft metal die, except when used for the purposes of his invention.

EDWIN PETTITT, of Birmingham, civil engineer. *For improvements in the manufacture of glass, in the method of forming or shaping and ornamenting vessels and articles of glass, and in the construction of furnaces and annealing kilns.* Patent dated May 25, 1850.

Claims 1.—A mixing machine, in the general arrangement and combination of parts of which the same consists.

2. The employment in the forming or shaping of vessels, and other articles of glass, of moulds composed in whole, or in part, of a mixture of silica, or silicious earth, and mucilage.

3. The ornamenting of vessels and other articles of glass by laying colouring matters in a powdery or pasty state upon the moulds, from which the same are cast, or by incorporating such powdery or pasty colouring matters, into the body of the glass.

4. The ornamenting of vessels and other articles of glass by imbedding, enveloping, or inclosing therein, or combining therewith pieces of glass, plain or coloured, or of metal, previously stamped, cast, or cut into ornamental forms, or films of metal precipitated by electricity of certain previously determined forms.

5. The ornamenting of plates and sheets, and of vessels and other articles of glass by a combination of any two or more of the aforesaid processes, or of any one or two, or more thereof, in combination with any known process or processes.

6. An apparatus for casting plates of glass, and a particular mode of using the same; that is to say, in so far as regards the materials of which the casting table is composed, the causing of the table to move under a stationary roller, which is made to rotate by the motion of the table, and the annealing of the glass before removing it from the casting table.

7. The constructing of tables for casting glass of materials and compounds of materials being bad conductors of heat.

8. An apparatus for casting, in so far as regards the combination of the roller with a receiver, and the mode in which these two parts of the apparatus are worked in unison, and in so far also as regards the casting of the plates or sheets of glass on the sole of the annealing kiln, and the construction of the sole of the annealing kiln, so to be used, wholly or in part of bad conducting substances.

9. A peculiar construction of casting table in so far as regards the employment of guides for steadying the roller and regulating the thickness of the plates.

10. A method of forming tubes or pipes of glass by means of grooved rollers and mandrils, or cores.

11. A method of forming cylinders of glass by centrifugal action.

12. Different constructions of glass furnaces, in so far as regards the substitution of cells for pots (either wholly or in part), and an angular inclination given to the side walls, the employment of moveable covers or stoppers, and a mode in which (in certain cases) air is introduced.

13. The forming of the roofs of furnaces employed for the manufacture of glass of boilers laid longitudinally (or otherwise) over the same.

14. A method of arranging and working a series of furnaces, as also a modification of the same.

15. An apparatus for applying air or steam to furnaces.

16. A peculiar mode of constructing annealing kilns.

17. Several improved machines for grinding and polishing glass, in so far as regards the arrangements by which the bottom tables are made to revolve simultaneously with the upper tables, the combination thereby effected of the grinding and polishing machinery, and an arrangement by which an elliptical motion is given to the upper tables or runners.

18. An improved grinding and polishing machine, in so far as regards the combination of a reciprocating table with a series of revolving rollers.

19. A grinding and cutting machine, and its application to the production of slots or openings in plates or sheets of glass.

20. The application generally of metallic surfaces to the grinding and polishing of plates and sheets of glass, in manner exemplified and described.

21. A machine for perforating or drilling holes in plates or sheets of glass, as described.

FRANK CLARKE HILLS and GEORGE HILLS, of Deptford, Kent, manufacturing chemists. *For certain improvements in manufacturing and refining sugar.* Patent dated June 1, 1850.

These improvements consist in the employment of sulphite of lead, to abstract the sulphuretted hydrogen or hydrosulphurets of earths employed in refining sugar. The sugar is to be kept at a temperature of about 180° Fahr., and the sulphite of lead, reduced to a creamy consistence by the addition of water, to be stirred in till the hydrogen or hydrosulphuret is absorbed, which may be tested by acetate of lead. In some cases carbonate of lead and precipitated protoxide of iron may be substituted for the sulphite of lead.

Claim.—The employment of sulphite of lead, carbonate of lead, or precipitated protoxide of iron, for abstracting from sugar the carburetted hydrogen or hydrosulphurets of earths employed in the process of purifying such sugar.

GEORGE HAYWARD FORD, of St. Martin's-le-Grand, gentleman. *For improvements in obtaining power* (A communication.) Patent dated June 3, 1850.

The "power" proposed to be obtained by Mr. Ford is, as will be perceived from his claim, neither more nor less than the long sought for "perpetual motion."

Claim.—"I claim the adaptation of certain principles of nature to machinery, using as a principal vehicle the well-known and used laws of centrifugal force, to avail myself of the laws that govern elastic fluids, heretofore unknown as a motor, and whereby I am enabled to destroy the equilibrium of power between the moving parts, precisely as in the steam engine; and I am enabled to keep up this destruction of equilibrium with much less power than is produced thereby; and the power so to be, and that can be produced, is limited only by the capability of matter and machinery to sustain it, and is in principle infinite"!!

WEEKLY LIST OF NEW ENGLISH PATENTS.

James Bendall, of Woodbridge, Suffolk, machinist, for improvements in certain agricultural implements. November 23; six months.

George Shepherd, of Holborn-bars, London, civil engineer; and Charles Button, of the same place, operative chemist, for certain improvements in the means or appliances used in conveying telegraphic intelligence between different places. November 23; six months.

Christopher Nickels, of York-road, Lambeth, Surrey, gentleman, for improvements in the manufacture of woollen and other fabrics. November 23; six months.

John Hamilton, of Prince's-square, Glasgow; and John Weems, of Johnstone, Scotland, for improvements in warming and ventilating buildings and structures. November 25; six months.

Henry Duncan Preston Cunningham, of Bury, Hants, paymaster and purser in the Royal Navy, for improvements in reefing sails. November 30; six months.

Frederick Buonapart Anderson, of Gravesend, Kent, optician, for certain improvements in spectacles. November 30; six months.

Robert Olddiss Bancks, of the firm of Bancks, Brothers, of Wierhouse Mill, Chesham, Bucks, and 20, Piccadilly, London, paper-makers and card-makers, for improvements in the manufacture of paper. November 30; six months.

Francis Frederick Woods, of Pelham-terrace, Brompton, Middlesex, builder, for improvements in paving. November 30; six months.

John Ainslie, of Alperton, Middlesex, now residing at Perry-hill, Sydenham, Kent, draining engineer, for certain arrangements and apparatus for the manufacture of bricks, tiles, and other articles made from clay and other plastic substances, parts of the said arrangements and apparatus being applicable to the treatment and preparation of earths, minerals, animal and vegetable matters. November 30; six months.

James Augustus Elmslie and George Simpson, of Union-buildings, Leather-lane, Holborn, importers of quicksilver and tin foil manufacturers, for improvements in sheathing ships and in protecting and confining gunpowder and certain compounds thereof, and in the materials used for such purposes. November 30; six months.

Henry Potter Burt, of the Blackfriars-road, Surrey, civil engineer, for improvements in the manufacture of window-blinds. November 30; six months.

William Henry Ritchie, of Kennington, Surrey, gentleman, for improvements in stoves. November 30; six months.

Joseph Eugene Chabert, of Paris, France, for improvements in machinery for washing and drying linen and other fabrics. November 30; six months.

Richard Barber, of Hotel-street, Leicester, lace cotton-winder, for improvements in the manufacture of reels for reeling and stands for reels, which improvements are applicable to the manufacture of desk or wafer seals. November 30; six months.

Henry Jules Boril, of Boulevard Poissonere, France, engineer, for improvements in the manufacture of bricks. November 30; six months.

Charles Rowley, of Birmingham, manufacturer, for improvements in the manufacture of dress pins and other dress fastenings and ornaments. November 30; six months.

Richard Blakemore, of the Leys, Ganerew, Hereford, Esq., M.P., for improvements in the construction of ploughs. Nov. 30; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Nov. 20	2543	Joseph Last	Haymarket	The Continental wardrobe portmanteau.
,,	2544	Joseph Walker Smith	Birmingham	Button.
21	2545	John Allen	Clarence-place, Hackney-road	Rocking-horse.
,,	2546	G. H. and G. Nicoll	Dundee	Portable family mangle.
,,	2547	W. and C. Middleton	Long-acre	Centripetal wheel-plate.
,,	2548	Francis Cranmer Penrose	Trafalgar-square	The Helicograph, or logarithmic spiral compass.
22	2549	George Smith	Castle-street, Liverpool	Waistcoat having a buoyant lining.
,,	2550	Deane, Dray, and Deane	King William-street, London-bridge	Improved stove.
23	2551	Charles Boardman	Pond-street, Sheffield	Cover for cruet or spirit frame.
,,	2552	Ross and Sons	Bishopsgate street	Shield for a comb.
25	2553	Burgess and Key	Newgate-street	Grater.
,,	2554	William Riddle	East Temple Chambers, Whitefriars	Latch and bolt union.

CONTENTS OF THIS NUMBER.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1426.] SATURDAY, DECEMBER 7, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

FERGUSON'S IMPROVED GUN-CARRIAGE.

Fig. 1.

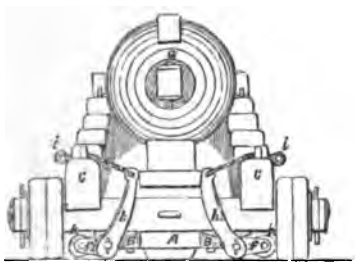


Fig. 2.

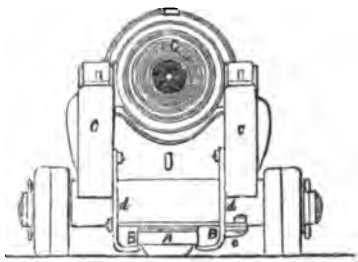


Fig. 3.

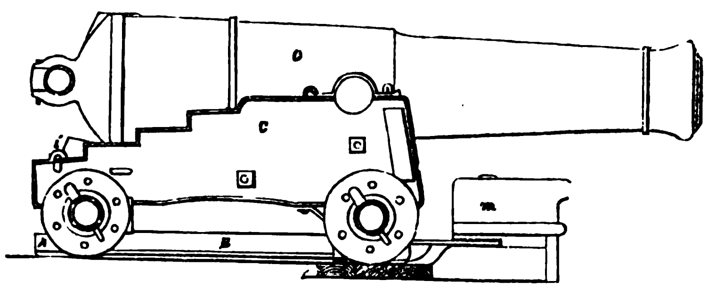
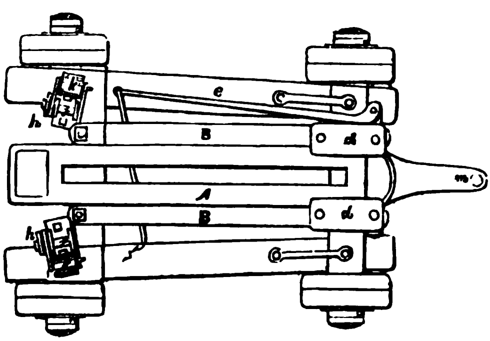


Fig. 4.



FERGUSON'S IMPROVED GUN-CARRIAGE.

[Registered under the Act for the Protection of Articles of Utility. Messrs. C. A. and T. Ferguson, of the Mast House, Millwall, Poplar, Proprietors.]

This invention consists of a most ingenious application of the slide to common broadside carriages, including friction chocks, training chocks and trucks, of an improved form. Fig. 1 is a rear-end view, and fig. 2, a front view; fig. 3, a side elevation, and fig. 4, a plan (bottom upwards), of a gun carriage constructed agreeably to these improvements. G is the gun, and C the ordinary broadside carriage. A is a small tracing slide; B, the friction chocks, acted upon by the jamming and steadying plates *d*, through the medium of a lever *e*; the pulling of which brings the friction chocks forcibly against the slide A. *f* is an improved training apparatus brought into action by pulling a lever *h*, which is fitted with a rope and eye *i*, to receive the hook of the tackle. When either of the levers *h* are pulled, the rear end of the carriage is supported upon the rollers *k*, and the gun trained to the full extent of its range to the right or left with great facility. The slide A of the carriage is pivoted to the centre of the port by a connecting bolt *m*.

These important improvements can be fitted to the broadside carriages now in use, without occupying any more room on deck; nor would their application alter the general appearance or system of exercising the guns, while a saving of 30 per cent. would be effected in time and labour, as compared with the working of ordinary carriages. The friction chocks act as a powerful check to the recoil, and also prevent the guns running out otherwise than required, their movements being under perfect control by one man, and capable of being regulated with the utmost nicety. Guns fitted with the improved carriage may be secured at sea by any of the usual methods, in *addition to which* they will have the powerful aid of the friction chocks to keep them in their places. In case of injury, all the parts are easily repaired, and should it be necessary to transport the guns on shore, or on board other vessels, the added improvements will in no way impede their usefulness as common carriages; or, the additions may be removed in a few minutes, if required.

The ordinary broadside carriage, when fitted with these improvements, is lighter, less expensive, has the weight lower on the base, and is as easily worked as the best slides and carriages, besides having the greatest possible angle in horizontal pointing.

The improved *friction chocks* are well adapted for slide carriages, as they act against the inner sides of the slides near the points of suspension; consequently any required amount of friction can be easily, safely, and simultaneously applied and controled by one individual.

B.

GEOMETRICAL NOTES. BY T. S. DAVIES, ESQ., F.R.S., F.S.A., ETC.

(Continued from page 267.)

III. *The Elements of Euclid.*

It has been suggested by one of the most eminent men of the present age as a curious subject of speculation, "what would have been the present state of geometry if the Elements of Euclid had been lost in the general wreck of ancient literature?" Perhaps it would be impossible to suggest another question relative to geometry, so pregnant with instruction; and certainly the consideration of this one question will show us that, despise the "Element" as we may (and as some of our shallow modern "analysts" really do), we are indebted to that work for both the form, the spirit, and the essential matter, of a large portion of our most improved mathematics.

At the same time, there is as little wisdom in asserting that the "Elements" is a *perfect work*, as there is in alleging that it is a jejune and worthless composition. In this country we seem in general to cling to the former view; whilst on the Continent the latter opinion is generally and openly expressed. In this country, therefore, most attempts to produce an elementary treatise on geometry, have ended in a varied text, or a close imitation of Euclid; whilst on the Continent very few attempts have been even moderately successful, where the

variation from Euclid's method has been considerable. Legendre (and in the estimation of some, though not in mine, Bertrand of Geneva) may be specified as almost the solitary case; and even he has vitiated the science in one part quite as much as he has improved it in another. There is, hence, something about Euclid's work, besides its venerable antiquity, upon which its celebrity rests: there must be something *inherent* and *indestructible*; — something which is peculiarly fitting between the subject itself and Euclid's mode of treating it. In truth, every genuine mathematician, be he professedly analyst or geometer, feels (as Sir W. R. Hamilton emphatically expressed himself at the Cambridge meeting of the British Association) that "with the man who undervalues the ancient geometry, and who does not reverence Euclid, he could hold no scientific communion."

Participating in the same feelings so strongly as I do, I approach to an analysis of this illustrious work with as little temerity and with as much misgiving as a man can well feel. The remarks I shall have to make are not the off-hand thoughts of the moment, but the result of more than thirty years' careful consideration, though only now put down *in their present form* for the first time. I shall not waste space in circumlocution or apology, however, but offer what I have to say in a frank and straightforward manner, and with the same freedom that I should discuss a work of more humble character.

The first step necessary in this discussion is, to give a brief account of the nature of the propositions in the "Elements." This, however, I find ready done to my hand, in the succinct but elegant work of Mr. Potts—his "Appendix to the larger edition of Euclid." As I considered it would be impossible for me to improve upon what my friend has there given, I have applied to him for permission to transfer it into my own "NOTES"—a permission which I need not say was granted with that liberality and promptitude for which Mr. Potts is so remarkable.

On the Classification of Propositions.

There are only two forms of propositions in the Elements, the *theorem* and the *problem*.* In the *theorem* it is asserted, and is to be proved, that if a geometrical figure be constructed with certain specified conditions, then some other specified relations must *necessarily* exist between the constituent parts of that figure. Thus, if squares be described on the sides and hypothenuse of a right-angled triangle, the square on the hypothenuse must *necessarily* be equal to the other two squares upon the sides (Euc. i. 47). In the *problem*, certain things are given in magnitude, position, or both, and it is required to find certain other things in magnitude, position, or both, that shall *necessarily* have a specified relation to the data, or to each other, or to both. Thus, a circle being given, it may be required to construct a pentagon, which shall have its angular points in the circumference, and which shall also have both all its sides equal, and all its angles equal (Euc. iv. 11.)

In Euclid's propositions, it may be remarked, there is in general an aim at *definiteness*, considered in reference to the *quæsitum* of the problem and the *predicate* of the *theorem*. The *quæsitum* of the problem is either a single thing, as the perpendicular in Euc. i. 11; or at most two, as the tangents to the circle in the first case of Euc. iii. 17; and in the most general problems, even those which transcend the ordinary geometry, the solutions are always restricted to a definite number, which can always be assigned *à priori* for every problem. In certain cases, however, the conditions given in Euclid are not sufficient to fix entirely the quæsitum *in all respects*. For instance, Euc. iv. 10, the magnitude of the triangle is any whatever, and therefore not entirely fixed in all respects; or, again, in Euclid iv. 11, the pentagon may be any whatever, so that its position in the circle is not fixed. To fix the *magnitude* of the triangle or the *position* of the pentagon, some other condition independent of the data must be added to the conditions of the problem. The length and position of some line connected with the triangle (as one of the equal sides, the base, the perpendicular, &c.) would have fixed the triangle in magnitude and position; and the position of one angular point of the pentagon, or the condition that one side of the pentagon should pass through a given point (though this point must be subject to a certain restriction as to position, if within the

* These distinctions are not made in any of the Greek MSS.; the general name of "propositions" being applied both to theorems and problems. There is good *internal evidence*, however, that they existed in the time of Euclid. Of this more hereafter.—T. S. D.

circle), or any other possible conditions, would have confined the pentagon to a single position, or to the alternative of two positions. Such is the only kind of indeterminateness in the *problems* of "the Elements." In the enunciation of the *theorems* too, the same aim at *singleness* in the property asserted to be consequent on the hypothesis is apparent throughout. There is, however, a remarkable difference in the characters of the hypotheses themselves, in Euclid's theorems, viz.

(1) That in some of them, one thing alone, or a certain definite number, possess the property which is affirmed in the enunciation.

(2) That all the things constituted subject to the hypothetical conditions possess the affirmed property.

As instances of the first class, the greater number of theorems in the Elements may be referred to, as Euc. i. 4, 5, 6, 8, which are of the simplest class. In these, only one thing is asserted to be equal to another specified thing. In all the theorems of the Second Book one thing is asserted to be equal to several other things taken together; and the same occurs in Euc. i. 47, as well as frequently in the other Books. They sometimes also take the form of asserting that no certain magnitude is greater or less than another, as in Euc. i. 16, or that two things together are less than or greater than some one thing or several things, as Euc. i. 17. In all cases, however, this class is distinguished by the circumstance that the things asserted to have the property are of a given finite number.

As instances of the second class, reference may be made to Euc. i. 35, 36, 37, 38, where all the parallelograms in the two former, and all the triangles in the two latter, are asserted to have the property of being equal to one given parallelogram or one given triangle. Or to Euc. iii. 14, 20, 21; the lines in the circle in Prop. 14, or the angles at the circumference in Props. 20, 21, are any whatever, and therefore *all* the lines or angles constituted as in the enunciations, fulfil the conditions. Or, again, in Book v. the two pairs of indefinite multiples, which form the basis of Euclid's definition of proportionals; or his propositions "*ex æquo,*" and "*ex æquo perturbato,*" and the Propositions F, G, H, K; or, lastly, Euc. vi. 2, in which the property is (really, though not formally) affirmed to be true when any line is drawn parallel to any one of the sides of the triangle.

The very circumstance, indeed, just noticed parenthetically, prevails so much in Euclid's enunciations as to render it clear that it was his object as much as possible to render the conditions of the hypothesis *formally* definite in number; and if these remarks had no prospective reference, the circumstance would scarcely deserve notice. Still, with such prospective reference it is necessary to insist upon the fact that, however the form of enunciation may be calculated to remove observation from it, the hypothesis itself is indefinite, or includes an indefinite number of things which an additional condition would, as in the case of the problem, have restricted either to one thing or to a certain number of things.

Sometimes, too, the theorem is enunciated in the form of a negation of possibility as Euc. i. 7, iii. 4, 5, 6, &c. These offer no occasion for remark, except to the ingenious modes of demonstration employed by Euclid. All such demonstrations must necessarily be indirect, assuming as an admitted truth the possibility of the fact denied in the enunciation.

Both among the Theorems and Problems cases occur in which the hypotheses of the one and the data or quæsita of the other are restricted within certain limits as to *magnitude* and *position*. The determination of these limits constitutes the doctrine of *maxima* and *minima*. Thus, the limit of possible diminution of the sum of the two sides of a triangle described upon a given base is the magnitude of the base itself, Euc. i. 20, 22; the limit of the side of a square which shall be equal to the rectangle of the two parts into which a given line may be divided, is half the line, as it appears from Euc. ii. 5; *the greatest line* that can be drawn from a given point within a circle to the circumference, Euc. iii. 7, is the line which passes through the centre of the circle; and *the least line* which can be so drawn from the same point is the part produced of the greatest line between the given point and the circumference. Euc. iii. 8 also affords another instance of a maximum and a minimum when the given point is outside the given circle.

The theorem Euc. vi. 27 is a case of the *maximum* value which a figure fulfilling the other conditions can have; and the succeeding proposition is a problem involving this fact among the conditions as a part of the data, in truth, perfectly analogous to Euc. i. 20, 22; and finally, there are instances either direct or virtual in Euc. xi. 20, 21, 22, 23.

The doctrine itself was carefully cultivated by the Greek geometers, and no solution of a problem or demonstration of a theorem was considered to be complete in which it was not determined whether there

existed such limitations to the possible magnitudes concerned in it, and how those limitations were to be actually determined.

Such propositions as directly relate to *maxima* and *minima* may be proposed either as theorems or problems. For the most part, however, it is the more general practice to propose them as problems; but this has most probably arisen from the greater brevity of the enunciations in the form of a problem. When proposed as a problem, there is greater difficulty involved in the solution, as it required to find the limits with respect to *increase* and *decrease;* and then to prove the truth of the construction: whereas in the form of a theorem, the construction itself is given in the hypothesis.

It may be remarked, that though the Differential Calculus is always effective for the determination of maxima and minima (in cases where such exist), yet in numerous cases where it is applied to problems of the classes which were cultivated by the ancient geometers, it is far less direct and elegant in its determinations than the geometrical methods. Now if reference be made to what has been stated respecting theorems, where the hypothesis is *indeterminate*, or wanting in that completeness which reduces the property spoken of to a single example of the figure in question, a consequence of that *peculiarity* in such classes of propositions may be remarked.

This peculiarity introduces another class of propositions, which, though in "the Elements" somewhat disguised, formed an important portion of the ancient geometry: —the doctrine of *loci*.

If the converse of Euc. i. 34, 35, 36, 37, and Euc. iii. 20, 21, be taken in the form of problems, they will become,

(1.) Given the base and area, to construct the parallelogram.

(2.) Given the base and area, to construct the triangle.

(3.) Given the base and vertical angle, to construct the triangle.

Now *three conditions* are necessary to fix the magnitude of a triangle or a parallelogram, and in general, three only are sufficient for the purpose; but here it will be observed that only two are given in each case. The precise triangle or parallelogram, viewed as peculiarly solving the problem, cannot be separated from all the others, except by adding some third condition to the two already given.

The side of the parallelogram in (1), and the vertex of the triangle in (2), opposite to the base, may be in any positions in a certain line parallel to the base; and the vertex of the triangle in (3), may be at any point in the circumference of a segment of a certain circle. The parallel line in which the vertices of all the equal triangles are situated, in one case, and the arc of the circle in which the vertices of all the triangles having equal vertical angles are situated, is each called the *locus of the vertex* of the triangle, since it occupies, in each case, *all the places* in which that vertex may be situated so as to fulfil the required conditions. In the same way, the parallel to the base is also the locus of all the positions in which the other two angular points of the parallelogram may be situated. These problems are the simplest instances of that class which is called *local problems;* and their peculiar character is, that the data are one less than the number of conditions required by the nature of the problem to restrict the quæsitum to a single or specified number of cases; as in these problems the data consist of two conditions, while the exactly defining conditions must be three.

Again; viewed as theorems, they may be thus enunciated:—

(1.) If the base and area of a parallelogram be given, the locus of the other angular points will be a straight line parallel to the base.

(2.) If the base and area of a triangle be given, the locus of its vertex is a straight line parallel to the base.

(3.) If the base and vertical angle of a triangle be given, the locus of the vertex will be an arc of a circle.

In the original form of the propositions the entire meaning, and that justified by Euclid's own reasoning, is that which would result from saying "all triangles," "all parallelograms," &c. It will obviously be the case here, as in the *maxima* and *minima*, that the proposition may be enunciated either as a *local theorem* or as a *local problem;* and the circumstances will be similar as to the comparitive brevity of enunciation and difficulty of the solution, when the proposition is given in the form of a problem.

The great use made of *loci* by the ancient geometers was in the construction of determinate problems. A certain number of data are required according to the nature of the problem for rendering the quæsitum determinate; as, for instance, those in the case of the triangle. The subject will be better illustrated by an example, and one may be founded on the second and third propositions already noticed, which will take the following form:—

Given the base, the area, and the vertical angle of a triangle, to construct it.

When the base and the area of a triangle are given, the locus of its vertex is a straight line which can be determined from these data; and when the base and vertical angle

are given, the locus of the vertex is a portion of the circumference of a circle which can be determined from these data. Now the point or points of intersection of these loci will fulfil both conditions, that the triangle shall have the given area, and the given vertical angle. To express the principle generally—let there be n conditions requisite for the determination of a point which either constitutes the solution, or upon which the solution of the problem depends. Find the locus of this point subject to $(n-1)$ of these conditions; and, again, the locus of the point subject to any other $(n-1)$ of these conditions. The intersection of these two loci gives the point required.

It may be observed that $(n-2)$ of the data must be the same in determining the two loci, and no one of the n data must be a consequence of, or depend upon, the remaining $(n-1)$ data, in other words the n data must separately express n independent conditions.

There are, however, cases in which one datum is involved in another, and these are of two different kinds—*essential* and *accidental*. To illustrate this distinction, let the following problem be taken:

Given the base, the area, and the perpendicular drawn from the vertex to the base of the triangle, to construct it. Or,

Given the base, the vertical angle, and the sum of the other two angles at the base of the triangle, to construct it.

Now in each of these problems, the third datum is absolutely determined and invariable, in consequence of its essential dependence on the two previous ones.

This dependence is universal and *essential*,

Again; suppose the problem were:—

Given the base of a triangle and a circle in magnitude and position, and likewise the vertical angle, to construct the triangle which shall have its vertex in a given circle.

In this case the given circle will generally be a different one from that which forms the locus of the vertical angle, and in that case, the intersections, or the point of contact, of the two circles will give either two solutions or one solution of the problem. But on the other hand, the given circle *may* coincide with the locus, and thus again render the problem indeterminate in this particular case. Generally the construction is possible, and only *accidentally* it becomes indeterminate.

The distinction between these two cases is very important.

As problems are generally constructed by the intersections of loci, it is easy to imagine cases and conditions that shall give loci which can never meet.

For instance, in the problem just stated, the two circles may never meet; and in the preceding one, the straight line and circle may never meet. In all such cases the problem is *impossible* with the given conditions: these conditions being incompatible with each other in their nature, or more frequently, in their magnitude and position, and with the co-existence of that which constitutes the quæsitum. The limiting cases of possibility belong to the doctrine of maxima and minima.

The importance of the distinction alluded to, when one datum is contained in another, arises from its constituting the foundation of another class of propositions. These are the *porisms*.

Whenever the quæsitum is a point, the problem on being rendered intermediate, becomes a locus, whether the deficient datum be of the essential or of the accidental kind. When the quæsitum is a straight line or a circle (which were the only two loci admitted into the ancient elementary geometry), the problem *may* admit of an *accidental intermediate* case; but will not *invariably*, or even very frequently, do so. This will be the case when the line or circle shall be so far arbitrary in its position as depends upon the deficiency of *a single* condition to fix it perfectly:—that is, for instance, one point in the line, or two points in the circle, may be determined from the given conditions, but the remaining one is indeterminate from the accidental relations among the data of the problem.

Determinate problems become indeterminate by the merging of some one datum in the results of the remaining ones. This may arise in three different ways; first, from the coincidence of two points; secondly, from that of two straight lines; and, thirdly, from that of two circles. These, further, are the only three ways in which this accidental coincidence of data can produce this indeterminateness; that is, in other words, convert the problem into a porism.

When it is considered that several of these topics form, in reality, branches of large and independent systems of inquiry,—and that some of them, and probably all, had begun to take distinct forms, even in Euclid's time: We cannot fail to be impressed with a sense of the great mastery over his subject which the immortal Greek displayed in reducing them all to two forms (theorem and problem) of enunciation, and one method of demonstration. It has ever been found, through all subsequent time, that the composition of a good book of "Elements" on any scientific or literary subject, is more difficult than even origi-

nal investigation of new truths; and no class of books, either in arts or letters, have presented so many failures as elementary ones. Such books have been attempted by all grades of minds, from that of him who barely comprehended his subject in the most confused manner, to that of the man of profound learning and most original powers: yet, Euclid's "Elements" still stand as the only accredited work for the student, and the only one which does not change its place at least once or twice in an age in public estimation. So much, indeed, is this work a stereotype, that the wood-engravers, when they have no other employment, engrave a set of diagrams for it, as the surest speculation to which they can devote their leisure.

The want of acquaintance with the more philosophical doctrines of Aristotle, respecting classification,—or more probably his utter rejection of them for reasons before hinted,—has however, produced some effects upon the composition of the Elements of Euclid, which will be presently noticed in detail,

(*To be continued.*)

THE AMERICAN CHURN MANIA.

[From the Sub-Report of Examiner Page to the American Commissioner of Patents for 1849.]

The first impulse seems to have been given by the grant of a patent for a churn in which there were boxes upon opposite sides of a common revolving dasher, so situated that as the dasher revolved, the box containing the cream, with its open mouth downwards, carried down a portion of air to the bottom of the churn, and as the mouth of the box inclined upwards, the air escaped from it through the mass of the cream, while the box itself filled with the cream, and as it came out and revolved in the upper part of the churn above the cream, that contained in the box was thrown out and scattered into spray. Both the descent and size of the box occasioned a commingling of the air and cream, and answered the purpose of agitation as well perhaps as any form of dasher. The introduction of air plays no chemical part in the production of butter, its separation from cream being merely a mechanical process. And although the atmospheric churns operate to a considerable advantage, yet it is by means of more thorough agitation, which is increased greatly by the diffusion of air throughout the cream. As each portion of air rises through the cream it forms a bubble upon the surface before it escapes, and in some of the atmospheric churns where the dasher is constantly submerged, the whole mass of cream is converted into a complete mass of foam. From the success of such a churn as that above named in producing butter in a shorter time than other churns, a most enthusiastic speculation was at once commenced upon atmospheric churns, and inventive powers were racked to modify, mystify and contort a simple principle, with a view of producing novelties rather than improvements. From the immense number of churns used throughout the country great gains could not fail to follow the monopoly of a new and superior churn. The golden prospects have tempted many into the field, and it is quite curious to observe in this instance the natural drift of intellect, bringing the workings of independent minds into one common channel. A patent was granted for one species of atmospheric churn, but before this could have been known far beyond the walls of the Patent Office, two other inventors, each and all from different parts of the country, had laid claim to the identical improvement. One was from Ohio, the second from Illinois, and the third from Vermont. An interference was accordingly declared, and no sooner had the decision been made in favour of the patentee than three other inventors were found pressing their claims to the same invention. It presents an unprecedented case in the history of the Patent Office of seven persons, each a *bonâ fide* inventor, all claiming the same thing and about the same time, and all from distant portions of the country. This improvement consists simply in boring a hole through the entire length of a common upright churn dasher, and placing a valve either at the bottom or top of the dasher. This valve opens downwards, and when the dasher is raised with such rapidity that the cream cannot follow up, the air rushes down through the valve under the dasher, and upon the downward stroke the air is pressed out laterally and escapes by the side of the dasher and up through the mass of cream. It requires not a very quick motion and but little force to effect this, and the agitation is most complete. A full size model was exhibited in the office showing the operation with clear water only. Upon agitating the dasher, the water appeared as if in intense ebullition. Another peculiarity belongs to this churn worthy of note. In the common churn, the dasher has to be raised out of the cream at each stroke and plunged down with some force, and as this scatters the cream, it is necessary to cover the churn tightly and allow the dasher to play through a small hole in the centre of the cover; but in this atmospheric churn the dasher is kept

always under the surface of the liquid, and consequently there is no splashing of the cream, and the cover may be left off with safety, and enable you to watch the operation. A strong recommendation is its simplicity, and as one of the inventors stated, he could alter any common churn dasher to this principle for twenty-five cents.

Prior to this simple device for introducing air, several complicated inventions had been patented, and many more made and presented to the office to effect the same purpose. In truth this invention at first was not considered patentable, but after the exhibition of its actual operation by one of the inventors, a different view was adopted and a patent ordered to issue. As atmospheric churns were not new, the ground was taken that the use of any known means of introducing air was not patentable. The ground of action is correct in itself, but did not appear applicable in the case after a personal explanation from the inventor, and an exhibition of the operation and result of his invention. The patentability of an invention frequently turns upon a nice point, and inventions the most novel are sometimes the most worthless; while again others least novel in appearance, bearing the similitude of common and unpatentable devices, are most valuable and important in practice. Simplicity is the essence of true invention, and it is often interesting to see, after a multitude of complicated inventions to attain a certain end, some discerning, or perhaps fortunate inventor, demolish a whole labyrinth of combinations, and arrive at the result by means so simple as almost to rob invention of its charms. Such means as one would suppose should have been the first and not the last resort. Mingled with the surprise are oftentimes feelings of regret and chagrin by his competitors, that they had not discovered this most obvious path. To such cases the words of Milton are quite apropos:

> "The invention all admired, and each how he
> To be the inventor missed; so easy it seemed,
> Once found, which yet unfound, most would
> have deemed
> Impossible!"

Such cases are the most embarrassing to your examiners. If measured by the length and breadth of novelty, little is to be found, while yet the measure of utility has in no way been made to appear. But to return to the churns.

A modification of the last-named churn has been patented, in which the hole in the dasher at the lower part was large enough to contain a solid plunger, fitting loosely within the dasher, which acts the part of a second valve. There have been also several patents granted for ingenious forms of rotary atmospheric churns. These inventors crowded upon the office so numerously that they were examined with the most rigid scrutiny, and on several occasions, actual demonstrations by experiment of making butter, was required of the applicants, to satisfy the office that the inventions claimed justified their pretensions to be real improvements. In most of these cases, the results were unfavourable to the inventor; but in some, patents were ordered to issue. On one occasion an experiment was performed (humourously characterized by a bystander as a "churn race,") between a patented and a new churn, in which they both came out alike, making butter from new milk in two minutes and a half. Such a rapid separation of the butter, however, is by no means desirable, although this is the general aim of these improvements. We have it upon the highest chemical authority, that butter made so rapidly is not likely to be so good as that which is made slowly.

ON TWO REMARKABLE CUBICS. IN A LETTER FROM MR. LOCKHART TO MR. COCKLE.

My Dear Sir,—I have received your letter of the 26th October and the Magazine which accompanied it. It is beyond doubt that the equation which you have been discussing has two impossible roots; the proof is beneath. Your computations are accurate, but the result does not agree with mine, which is founded on Cardan's rule.

I am, my Dear Sir, faithfully yours, JAS. LOCKHART.

Fasnacloich, by Bonaw, Argyllshire, Oct. 31, 1850.

To JAMES COCKLE, Esq., Barrister-at-Law, Temple, London.

[*The Proof above alluded to.*]

Let $x^3-10x^2+10x-2{\cdot}64163101=0$;

taking away the second term, and dividing by 3, 9, 27,

$$y^3-210y-1171{\cdot}32403727=0.$$

If the absolute term had been $\sqrt{1372000}=1171{\cdot}32403714\ldots$ two roots would be equal, because

$$\frac{210^3}{1372000}=6{\cdot}75 \text{ similarly with the equation}$$

$$x^3-3x=2 \text{ where } \frac{27}{4}=6\cdot75;$$

but the absolute term in y is greater or exceeds, although by a very small quantity, $\sqrt{1372000}$, and therefore 210^3 divided by the square of the absolute term, which is 1372000·0002864923490529 gives a result less than 6·75, in which case two roots are certainly unreal, as they are in the equation $x^3-3x-2\cdot000001=0$.

Hence the original equation has two unreal roots.

P.S. On receiving the printed result, page 330 [*supra*] of the Magazine, I have imagined that the sign − should precede 1452·574879. If so, your result would agree with mine.* Here is another equation of the kind:

$$x^3-8x^2+8x-2\cdot14683057877559=0,$$

it has two impossible roots. If the last figure were 8, the two roots would be real. Stop at what figure you please in the absolute term and increase it by a unit, the two roots will be impossible.

[The following letter is also well worthy of attention.—J. Cockle.]

My Dear Sir,—I have received your kind letter, and No. 1405 of the *Mechanics' Magazine*. Your theorem on the nature of the roots of a cubic, published in the *Cambridge Mathematical Journal*, is very interesting

* * * *

Sturm's remainder might be easily adapted to an equation of the 5th degree, which I dare say you have examined. Has it occurred to you that the equation $x^5-px=q$ is always of the form $x^5-(a^4+3a^2b+b^2)x=a^3b+2ab^2$, a factor being $x^2-ax=b$? a and b may be positive or negative, either or both at pleasure.

I am truly, dear Sir,
Your obedient Servant,
James Lockhart.

Fasnacloich, August, 24, 1850.
James Cockle, Esq., London.

Mr. Cockle here subjoins an extract from a letter of Mr. Samuel Bills to him, dated Hawton, near Newark-upon-Trent, Nov. 20, 1850.

"You will excuse me if I take this opportunity of pointing out to you an error which you inadvertently committed in applying your rule for determining the nature of the roots of a cubic equation to Mr. Lockhart's celebrated equation at p. 339 of the current volume of the *Mechanics' Magazine*. I must confess that I was somewhat startled when you asserted that your process gave a different result to Mr. Lockhart's criterion. I had also tried it over *twice* by my own test, and found the same result as the author. I was the more surprised at your conclusion as I had previously satisfied myself of the *validity* of your rule. The error is, however, in your *arithmetical process*. Referring to p. 330, you will perceive that in multiplying" * * * "by 70 you have omitted the negative sign before the product" * * * "*adding* there, according to your rule at p. 490, last volume, the result is *positive* which indicates *one real* root, the same as Mr. Lockhart's test."

MR. SAMUEL'S NEW SYSTEM OF RAILWAY CONSTRUCTION.—(*See ante p.* 402.)

Specification.

The first of my improvements in the construction of permanent ways consists of what I term my longitudinal trough sleeper.

I make my longitudinal trough sleepers of cast or wrought iron, and I fix the rails firmly in the troughs of such sleepers by means of wooden linings. Fig. 1 is a transverse elevation of a pair of my longitudinal trough sleepers, showing the manner in which the rails are placed and secured within the troughs, and also the mode in which each pair of sleepers is held at a proper distance apart by means of transverse tie-rods, such tie-rods however, forming no part of my invention.

Fig. 2 is a plan (upon a reduced scale) of a portion of permanent way constructed and laid down according to this part of my invention, and fig. 3 is a side elevation (upon a reduced scale) of part of a line of rails, also constructed according to this part of my invention.

* Mr. Lockhart is correct in this supposition. I now see that our results agree, and that my own Rule indicates the existence of two unreal roots.—James Cockle, 2, Pump-court, November 4, 1850.

In fig. 1, *a*, *a*, *a* is the cast-iron trough of the sleeper; *b b* are side flanges, or bearing plates, which rest upon the ballast, and *c c*, is a transverse web for strengthening the sleeper. Each sleeper may be cast with six (as shown in fig. 3,) or such other number of transverse webs as may be deemed necessary; *d d* are wooden linings for fixing and holding the rail R firmly in the trough. I make these linings of wood, as being the cheapest material possessed of the requisite degree of elasticity, but of course any other material of sufficient durability, and having a similar amount of elasticity, may be employed. I have, in figs. 2 and 3, shown three sleepers supporting a single length of rail; but the sleepers may, if desired, be laid down close to each other, so as to be continuous, or such other number may be used for supporting a length of rail as may be deemed requisite.

Fig. 13. Fig. 1.

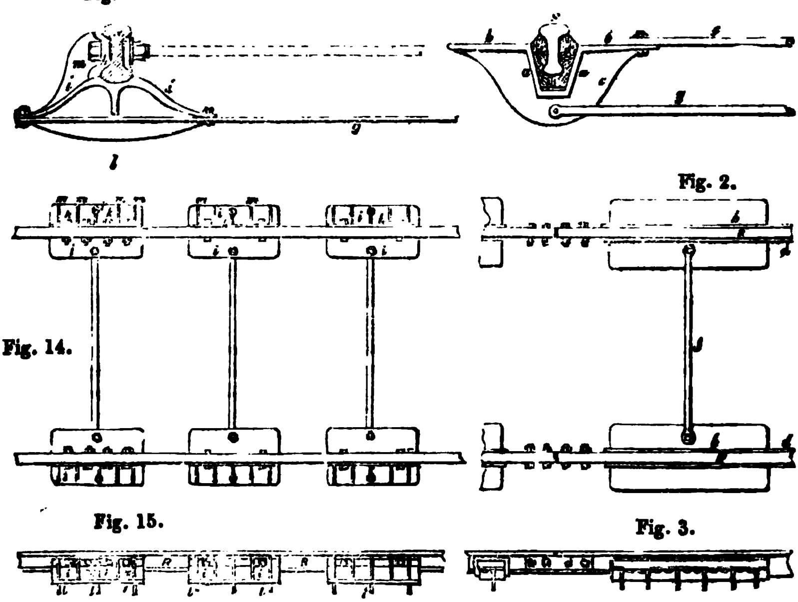


Fig. 14. Fig. 2.

Fig. 15. Fig. 3.

I have in figs. 2 and 3 shown the wooden linings extending the length of three sleepers, but the length of these linings may be restricted to the length of the troughs, and I think it better and more economical to do so.

The troughs shown in fig. 1 are wider at the top than at the bottom. The wooden linings are made so as to fit accurately to the rail, and to the sides of the trough, and of such thickness, that when inserted with the rail in the trough, they will not descend quite to the bottom of the trough. When wooden linings are placed against each side of a rail (as shown in fig. 1,) their sides will assume a wedge-like position, and being pressed down towards the bottom of the trough, the linings will grasp the rail firmly, and hold it securely in the intended position.

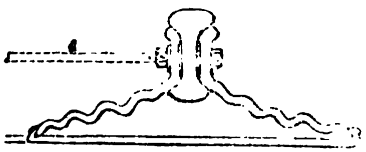
I have shown the troughs constructed in this form, because I deem it to be the best, but the sides of the troughs may be made vertical, and the linings and rails secured by means of wedges.

The transverse tie-rod *f*, will be sufficient to preserve the gauge of the line, but by adding the additional rod *g*, the rails may be canted if desired, and they will also be thus held more securely in their intended positions.

In figs. 2 and 3 I have shown the rails connected together at the points, and secured by means of iron fishes placed in

the side channels of the rails, according to the invention of Messrs. William Bridges Adams, and Robert Richardson, this being, in my opinion, the best mode of connecting rails for the purposes of this part of my invention.

Fig. 46.



Another of my improvements in the construction of such permanent way as expressed, consists of a metallic bearing plate or chair sleeper, the whole of which I make of one and the same piece of metal.

One mode of constructing this bearing plate is shown in figs. 13, 14 and 15; figs. 14 and 15 being upon a reduced scale. This bearing plate consists of a chair and sleeper made in one piece, the chair being made with only one jaw, to which the rail is to be secured by means of bolts, and nuts or rivets.

In the bearing plate shown in these figures, *h* is the chair or jaw already mentioned, strengthened by means of webs marked *m*; *i i* is the base, or sleeper upon which it is cast, the sleeper being cast with suitable webs or brackets, as shown at *l*, figs. 13 and 15 for the purpose of strengthening them. The rail R is shown in figs. 13, 14 and 15, as fixed to the jaw or chair by means of bolts and nuts, and when the chair-sleeper is placed at a joint of the rails, the joint is secured by means of a fish, *n*, (seen in fig. 13) and a greater number of bolts and nuts as shown in figs. 14 and 15.

The gauge of the rails will in this case be preserved by means of tie-rods attached to the chair-sleeper, either as shown in the figures or in any other convenient manner.

A *corrugated* bearing plate made in two pieces, is shown in fig. 46. When so made, I secure the rail between the two half plates, by bolts passing through the rail and the plates, as shown in the figure. The parts of these half plates which are placed next the rails, are made to fit the side channels of the rails, so that the upper lips of the rails may have bearings upon the plates. Bearing plates constructed in this way, when secured to the rails at the joints, will have a similar effect to the fishing of them.

I connect these half plates together by means of tie rods (G, fig. 46,) in order to strengthen them; and such rods may be continued across to the other rail of the railway, as before mentioned. Figs. 47 and 48 show (on a reduced scale) a plan and side view respectively of a portion of permanent way with similar bearing plates and rails secured between them. These plates may also be laid down either continuously or with intervals between them, and they may be made either of wrought or cast iron, but I prefer the former. The bearing plates, lastly described, may be used or applied to other forms of rail, as well as that shown in fig. 46.

MATHEMATICAL PERIODICALS.

(Continued from page 415.)

XXV.—*The British Diary.*

Origin.—This periodical was projected in the early part of 1787, and the first Number was issued at Birmingham, towards the close of that year, under the title of "*Diaria Britannica; or, the British Diary.* Being an Almanack for the Year of our Lord 1788." The work was announced as "containing a variety of useful and entertaining matter in arts and sciences, calculated in a particular manner for the improvement of BRITISH YOUTH in the more sublime parts of MATHEMATICS." Nor do the editors appear to have spared any pains, in order to secure the services of some of the leading correspondents of the day in furtherance of their new undertaking. The following letter (for which I am indebted to Mr. Henry Buckley, addressed to Mr. John Ryley, of Beeston, not only affords confirmation of the preceding remark, but is worthy of preservation as an evidence of the high estimation in which the *future* editor of the *Leeds Correspondent* was held by his contemporaries, and of the peculiar value attached to his contributions. I do not find, however, that Mr. Ryley ever complied with the request of Mr.

Taylor, a circumstance which will probably find its explanation in the intimate connection which existed at this time between himself and the editors of several similar publications:—

Sir,—As we have actually agreed with Messrs. Pearson and Rollason, printers in Birmingham, to print an Almanack, which we intend to call "*The British Diary*," something similar to the "*Lady's*" and the "*Gentleman's Diary*," we shall be glad if you will therefore be so obliging as to favour us with some mathematical questions, with their solutions, or other matter suitable for such a work, to come to hand by the 16th June at the farthest, and they will be most thankfully received.

We are, Sir,

Your very humble Servants,

GEORGE TAYLOR AND PARTNERS.

Loscoe, Derbyshire,
May 6, 1787.

P.S.....If you please to favour us as before, we shall have no objection to *pay the postage* of yours.

The opening address to the "courteous reader" commences with an eulogium on the study of mathematics, and after remarking that "by its assistance we are enabled to penetrate into the most dark and occult secrets of nature," deduces the obvious conclusion "that every effort calculated to encourage or promote the study of polite literature and science, how imperfect soever the performance, ought in some measure to meet with the patronage and encouragement of the public. From these considerations the authors of the *British Diary* . . . . have, through the earnest solicitations of several learned correspondents and friends, been prevailed upon to undertake the ensuing annual publication, in order to open a larger field for our British youth to display their learned abilities in those sublime sciences." Correspondents are therefore advised "to make choice of such subjects as may tend to illustrate and improve such discoveries as are likely to be attended with public utility;" since these are always "preferable to those dark and metaphysical inquiries" which "bewilder the imagination in a labyrinth of uncertainty and error." Notwithstanding these precautions on the part of the conductors, the *British Diary* was not destined to enjoy a long existence, for it was discontinued with "the *ninth* Almanack published of this kind," for the year 1796.

Editors.—The first *seven* numbers were edited by Mr. John Cotes and Mr. George Taylor; the last *two* numbers by Mr. John Cotes and Mr. Patrick Hall.

Contents.—The usual contents of each number partake of the same general character as the *Lady's* and *Gentleman's Diaries* of the same period. The *first* part consists of an Almanack and Ephemeris for the year; a list of Festivals; Aspects and Weather; Time of High Water; Chronological Notes; Astronomical Characters; Eclipses; Equation of Time; and occasionally a Table of Minutes, or the residue of the Planets' places; &c, &c. The *second* portion comprises New Enigmas, Charades, Rebusses, Paradoxes, Anagrams, Queries, and Answers:—in the first Number the space afterwards devoted to Answers was occupied by a selection of "Miscellaneous Poetry," consisting of "The Dying Rake's Soliloquy," "Happiness," "On Innocence," "Friar Philip's Geese, a tale from La Fontaine;" &c. The *third* portion contains mathematical questions and answers, with occasional emendations and editorial remarks. Much of the poetry, so called, is of a very ordinary character, especially the answers to the enigmas, &c., in which some of the contributors would seem to have exerted themselves in order to set at defiance all the ordinary rules of rhythmical composition. Here and there a few meritorious efforts might be pointed out, which are indeed rendered conspicuous enough by their position; and in several of the later numbers there is evidence of a gradual improvement in the quality of the articles inserted. Mr. John Fildes, schoolmaster, of Liverpool, contributed many of the prize enigmas, some of which exhibit no mean skill in the art of hiding a subject. Several of the contributions by Messrs. Nield, Rimmer, Sheridan, Savage, Norris, and Kemp, are also superior to the generality; but the majority evince abundant proof of the very low standard which regulated the insertion of communications to this department.

Almost similar remarks apply to that portion of the work devoted to philosophical queries, &c. But few of the inquiries or answers present anything to

interest or instruct the general reader, and although the earlier numbers contain some interesting subjects, the answers returned display no great amount of philosophy; whilst the latter queries consist chiefly of explanations of what the contributors considered to be either contradictory or difficult passages of Scripture. On the whole, it may be remarked that the Editors did not succeed in producing a miscellaneous department *equal* to that of several contemporary periodicals, whilst even the best of these are far inferior in point of originality, elegance, and utility, to the selections now annually issued in the pages of the *Lady's and Gentleman's Diary*.

Questions—The mathematical questions proposed and answered in this periodical amount to 144, including a collection of 17 in No. 1, which were transferred into the pages of the *Diary* from the *British Miscellany*, a serial projected in 1780, and discontinued with the first number. Besides these, a selection of 18 questions were left unanswered on the discontinuance of the work, most of which were re-proposed and solved in Whiting's *Mathematical, Geometrical, and Philosophical Delights*. This proceeding, however, did not meet with the approbation of the proprietors of the *Diary*, and I am informed by Mr. Henry Buckley, on the authority of the late Mr. John Butterworth, that they afterwards disposed of the questions to Mr. Knowles, one of the proprietors and editor of the *Liverpool Student*, for the sum of 2*l.*; and they accordingly form the first set of questions in that valuable work. The contributors to the *British Diary* were never very numerous, yet at times the names of some of the leading mathematicians of the day appear in its pages. Several able contributions from Mr. Moulsdale and Dr. Dalton may be seen in the earlier numbers, and the final portions are enriched by the researches of Messrs. Todd, "Mancuniensis" (Holt), Buchanan, Brookes, Knowles, and the late Dr. Gregory, then "Assistant at Mr. Weston's Boarding-school, Yaxley, Hants." The subjects embraced by the questions include the whole range of mathematical science as then understood, and many solutions might be instanced as exhibiting fair specimens of the usual style of the period. The work, however, contains but few original theorems or problems of importance, and it is to be regretted that many of the best investigations are considerably disfigured by the very indifferent manner in which the work is printed.

Ques. 3 (No. 1), requires "the greatest equilateral triangle that can be taken out of a given square;" an inquiry which readily suggests the corresponding problem, "To inscribe an equilateral triangle in a given square, so as to have an angular point at one angle of the square." The latter problem has been constructed by *three* very elegant methods in the MS. remains of that distinguished geometer, the late Mr. J. H. Swale.

Ques. 17 (No. 1), gives "the inclination of the plane of the Theodolite with the horizon, to find the greatest error that can happen in taking an angle." It was proposed by Mr. Ralph Dutton and answered by Mr. Moulsdale.

Ques. 11 and 13 are proposed and solved by Mr., afterwards Dr. Dalton; the latter requires the *initial* velocity with which a ball must be projected from an eminence to reach the Antipodes, neglecting the resistance of the air; and the former computes the distance of a star from the sun when the latitude and annual parallax are given.

Ques. 19 by Mr. Joseph Hall, requires "the greatest semicircle that can be inscribed in a given square;" a problem which is neatly constructed and demonstrated by Mr. Holt, of Manchester, under his usual signature "Mancuniensis."

Ques. 21 relates to Equation of Payments, and was proposed by Mr. Joseph Hall apparently at the instance of Mr. Thomas Todd, who in a scholium to his solution charges Dr. Hutton with "very uncivilly, and very improperly suppressing the scholium to (his) solution in the *Lady's Diary* for 1789 . . . . for no other reason than that it contradicted his crude remarks on Equation of Payments in the 5th and 6th editions of his Arithmetic."

Mr. Todd seems to have been a somewhat troublesome correspondent, and extremely fond of a dispute. For upwards of thirty years almost every periodical bears ample testimony to his controversial disposition, and although

considerable space was frequently allowed him, he does not appear to have been gratified in this respect to the extent of his wishes; for at the close of his solution to Ques. 45 in this *Diary*, *omitted in the first instance by the compositor, and afterwards inserted by request*, he adds, "I sent this question and solution to the *Lady's Diary* in the year 1787, which they would not publish, because the person that disputed with me was their correspondent John Jackson."

Ques. 25 determines the place where a conical piece of timber must be cut so as to measure the most possible: a considerable number of similar investigations may be seen in Dr. Hutton's *Mensuration* and several more recent publications.

Ques. 38, by "Mancuniensis," gives "the angles and sum of sides of any plane triangle, to construct it." Elegant constructions are given by Messrs. P. Hall, Buchanan, and the proposer, who observes he was not previously aware of its appearance as Ques. 44 in the *Mathematician* of 1751.

Ques. 44 determines the fluent (integral) of the expression

$$\frac{dz}{\sqrt{\log.\ \frac{z}{b}}};$$

it was *twice* proposed by Mr. R. Waugh, and in No. 4 a solution was furnished by "*Virtuoso*."

Ques. 54 proposed by Mr. W. Salter, and answered by Mr. James Ashton, inscribes the greatest ellipse possible between the peripheries of two given concentric circles.

Ques. 58 and 59 give the "radii of two circles inscribed in a triangle touching each other," together with other requisite data to construct the triangles; they are proposed by "Mancuniensis," and answered by Mr. Samuel Banyard, of Great Yarmouth.

Ques. 70 relates to exchange, and is proposed by Mr. Todd under the signature "Philalethes Cleasbyensis," in consequence of its being "taken out of Clare's *Introduction to Trade and Business*, put into two books of arithmetic, and false solutions given in each book; after this sent it to the *Lady's Diary*, which also solved it false." Mr. Todd remarks that the solution to this question (894) in the *original Diary* contains *two* errors which nearly compensate each other; and this appears to have been Professor Leybourn's opinion —for in his edition of the *Diaries*, vol. iii., p. 200, he has suppressed the *original* solution by Mr. A. Whitehouse, of Wolverhampton, *and has inserted Mr. Todd's solution from the British Diary verbatim under Mr. Whitehouse's name, without the least acknowledgement to whom the correct solution was due!*

Ques. 73 and 74 relate to the construction of triangles from given data;—they were proposed by Mr., afterwards Professor Leybourn, respecting which Ferdinand remarks that the last "is the very same as Prob. 54, Simpson's *Select Exercises*."

Ques. 95, Prize 1794, is proposed by Mr. John Brookes, of Leeds, and requires "from a given point P, to draw two right lines PA, PB, making a given angle APB, and meeting a right line, and the periphery of a circle, both given in position in A and B respectively; so that the ratio of PA to PB may be the greatest or least possible." An elegant geometrical solution is given in the *Diary* by Ferdinando and the proposer: the problem itself is a generalization of Prob. 3, page 42, *Burrow's Diary*, 1776, and the case of the rectangle also forms Problem 5 of the same paper.

Ques. 106 gives "the ratio of two sides of a triangle inscribed in a given circle, to determine the triangle when its area is a maximum." It was originally proposed by Mr. George Sanderson as Ques. 768 in the *Lady's Diary* for 1780, and a solution was furnished to the *Diary* for 1781 by Mr. Henry Clarke, which Mr. Sanderson, in *Burrow's Diary* for 1782, p. 48, designated as a "false and pretended answer." An amended solution was given in the *Lady's Diary* for 1782, and an algebraical one also appeared in *Burrow's Diary* for 1783. Mr. Brookes gave a solution to the question as here proposed, and an elegant "additional" investigation by Dr. Wallace may be seen in *Leybourn's Diaries*, vol. iv., pp. 377-9.

Ques. 108, by Ferdinando, requires "to determine, geometrically, two lines in a given ratio, so that if a given line (L) be added to each, the rectangle of the compound lines shall be of a given magnitude." Good solutions were furnished by Messrs. Brookes and Saul

This question is a case of No. 60, *Burrow's Diary* for 1781, to which a solution was furnished by Mr. Jeremiah Ainsworth, of Manchester, grandfather to the gifted novelist, the present William Harrison Ainsworth, Esq. The generalized problem in all its cases is very ably and fully treated in the MSS. remains of the late Mr. J. H. Swale.

Ques. 111, Prize 1795, is proposed by Mr. I. Waters, and answered by Casia Broomwott (*Isaac Rowbottom*), Messrs. Fildes, Brookes, and Elliott; it demonstrated the following property: if a semicircular arc be divided into any two parts AP, PB, and these parts be bisected in C and D; then if AC, AD, BC, BD, be joined $(\triangle\ ACB)^2 + (\triangle ADB)^2 = R^4$. Several other properties of the diagram are pointed out, but they scarcely possess sufficient interest to merit transcription.

Ques. 127, Prize 1796, is proposed by Mr. Brookes and answered by Mr. Rowbottom and the proposer; it demonstrates the following property of the triangle: "ABC is a triangle, whose angles at the base are both acute. Now if a right line proceed from D, the middle of the base, making an angle therewith equal to the complement of half the difference of the angles at the base, and perpendiculars BG, CH, be demitted thereon from the angular points B, C, and CD joined; then the triangles DGB, DHC will be equal."

The only question of importance in the selection left unanswered has been noticed in the account of Whiting's *Scientific Receptacle*, current volume, page 367, Ques. 256.

Contributors.—Messrs. Ashton, Banyard, Brookes, Buchanan, Barr, Carlisle, Carwithen, Clark, Cock, Cross, Dalton, Dixon, Dutton, Elliott, Ferdinando, Fildes, Fletcher, Gregory, Hall (J. and P.), Hulland, Jackson, Keith, Kemp, Knowles, Leybourn, "Mancuniensis," Manifold, Marsden, Moulsdale, Needham, Nield, Norris, Nuttall, Rowbottom, Salter, Sapcoat, Saul, Savage, Sheridan, Shipsides, Simpson, Smith, Swift, Todd, &c., &c.

Publication.—The publication took place annually, about November in each year; four of the first numbers were issued at "ninepence," and the rest at "one shilling" each. All the work was "printed and sold by Thomas Pearson, Birmingham," and sold by "Champante and Whitron, Jewry-street, London."

THOS. WILKINSON.

Burnley, Lancashire,
Nov. 30, 1850.

Errata.

Page 414, Ex. 4, *series*, *for*

$$\frac{1}{v1}+\frac{1}{v2}+\frac{1}{v3}+\frac{1}{v4}+\&c.,$$

read

$$\frac{1}{\sqrt{1}}+\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{3}}+\frac{1}{\sqrt{4}}+\&c.$$

REGISTRATION ACT.—SCOPE OF THE WORDS "SHAPE AND CONFIGURATION."

Court of Queen's Bench.—Nov. 27, 1850.

Sittings in Banco.—Before Mr. Justice Patteson, Mr. Justice Coleridge, Mr. Justice Wightman, and Mr. Justice Erle.

ROGERS AND ANOTHER *v.* DRIVER.

The plaintiffs in this case were jointly interested in a design for making and ventilating bricks. The design had been registered pursuant to the statute (6 and 7 Vic., c. 65). In an action upon an agreement by which the defendant was to have the use of the invention and to pay an annual royalty of 7s. 6d. per thousand for the first million, 6s. per thousand for the second million, and 5s. per thousand afterwards, a verdict passed for the plaintiffs. Mr. Gray, for the defendant, having moved for a new trial on the ground that the invention was not a new and original design within the meaning of the Designs Act.

Mr. Alexander, Q.C., and Mr. Selfe, now showed cause *contra*. The question in this case is, whether the owner of an invention, even though he might have obtained a patent for it, may not abridge his rights by registering it under the Designs Act—whether he may not content himself with three years' benefit from it, instead of fourteen. Mr. Justice Patteson said at the trial, "Surely he may abridge his rights; and does it lie in the defendant to say it never was a subject of registration after he had signed an agreement treating it as such?" It was proved by uncontradicted witnesses that the design was useful. The invention consists in the "shape and configuration," and is useful; it is, therefore, not affected by 5 and 6 Vic., c. 100, which applies to ornamental articles of manufacture only.

Mr. Gray having been heard in support of the rule.

The Court.—The useful purposes to which the bricks are applicable are all the result

of their "shape and configuration"—the invention, therefore, comes within the very words of the Registration of Designs Act. The question does not arise whether it might have been made the subject of a patent; but, without deciding either one way or the other, there seems no reason why a man, who from the small value of a thing does not wish to incur the expense of a patent, should not be at liberty to register it as a design, if it is within the terms of the Act. The rule must be discharged.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING DECEMBER 5, 1850.

WILLIAM RADLEY, chemical engineer, and FREDERICK MEYER, oil merchant, both of Lambeth, Surrey. *For improvements in treating fatty, oleaginous, resinous, bituminous, and cerous bodies in the manufacture and application of them, and of their component and subsidiary products, together with the apparatus to be employed therein, to new and other useful purposes.* Patent dated May 25, 1850.

This specification, which the patentees justly style a "voluminous" one, is divided into eight "capitals," each of which is again subdivided into sections. We give the heads of the invention, which will suffice to convey a general idea of the various improvements described and claimed by them.

1. The depuration and debasement of oils and fats, the distillation of the debased oils and fats, and the application of the results of these several processes to lubrication, combustion, and saponification.

2. The procuration of oils and adipose matters from bones, animal flesh, the refuse and offal of slaughterhouses, fish-blubber, &c.

3. The production of insoluble soaps of lime, baryta, strontia, alumina, magnesia, and metallic oxides, generally and respectively, in combination with oily, fatty, and butyraceous bodies, or any of them; their depuration from glyceric and butyric acids, and decomposition, with the formation of soluble soaps applicable to general purposes, and of "candle block" to the manufacture of candles, whilst the economized glycerine is devoted to various useful applications which are enumerated.

4. The acquisition and use of "elaiostearine," otherwise "stearoptine," or the fatty matter from the berry, or beans of the "theobroma cacao" or cocoa-yielding fruit, and the application of the subsidiary "marc" from which the oil has been expressed to the manufacture of powders or pastes of cocoa, chocolate, and broma of a new kind, denominated "bromage," whilst the expressed fatty or oily matter, called by the patentees "theobromine," is applied to the manufacture of candles and other useful purposes.

5. The purification and adaptation of glycerine and lypine, the hydrated oxides of glycerule and lypule, together with alkaline, earthy and oxydic glycerates and sulphocarbono and phospho-glycerates to new and useful purposes.

6. The production of a series of compounds from the component acids of fatty, resinous, oleaginous, bituminous, and cerous bodies, or their derivatives, by double decomposition, and alkaline earthy or metallic salts, or by the combination of them, or any of them, with the bases of such salts generally and respectively, together with the application of such products either *per se* or in combination with other resinous, oleaginous, fatty, bituminous and cerous bodies, or any of them, to the manufacture of atmofuge and hydrofuge compounds to be employed as lackers, japans, and varnishes, in making printers' ink, smear cloth for pistons, &c., and for various other purposes.

7. The combination of organic acids with alkaline, earthy, and metallic bases, and of organic colouring matters with these several bodies, and their application *per se*, or dissolved in suitable menstrua, to the purposes of printing, calico printing, paper, leather, and wood staining, dyeing, and polychromatic embellishments generally.

8. This division contains descriptions of apparatuses employed in carrying out parts of the invention, such apparatus being denominated respectively the "aëro-dynamic extractor," the "atmo-dynamic extractor," and the "electro-depurator."

ALFRED VINCENT NEWTON, of Chancery-lane, mechanical draughtsman. *For improvements in couplings for carriages, and in the attachment of wheels to axles.* (Being a communication.) Patent dated May 28, 1850.

Claims 1. (In relation to the method of connecting the front axletree with the other parts of carriages.) The employment of a plate affixed to the lower side of the bolster and made to interlock with a plate attached to the upper side of the axletree by means of a flange on the bolster plate provided with notches to receive projections on the axletree plate. When this improved coupling is employed, the front axletree can only be detached by removing one of the wheels and bringing the axle under the carriage in a position at right angles with that occupied by it when both wheels are attached.

2. (In relation to connecting the whiffle tree to carriages.) The employment of

stops or blocks cast upon, or otherwise affixed to two plates (one attached to the whiffle tree, the other to the carriage,) in such manner, that when the two are joined by a central bolt they may interlock, with the privilege of a certain amount of play or traverse. To secure this traverse, the stops are formed segmentwise; each, however, being less than the fourth part of a circular plate. The advantage of this form of connection is, that even if a trace breaks, or unhitches, the interlocking of the plates obviates any hindrance to the draught, and renders one trace as efficient as two.

3. (With reference to the attachment of the bows used in opening or closing the calêche, or head of a carriage.) The combination of a shaft connecting the bows on each side of the carriage head, with an operating bar, for the purpose of permitting the occupant of a carriage to lock or unlock the bows from the inside, and thus open or close the calêche at pleasure.

4. (In connecting wheels to axles.) The employment of a hook, and spring and bolt in combination with a groove in the axle, or the equivalents of either, or any of them. This method of connection dispenses with the employment of linch pins. The bolt is for the purpose of raising the hook from the groove into which it takes, to admit of the wheel being readily removed. In a modification described by the patentee, the position of the groove is reversed.

5. (In relation to connecting those parts of wheels which receive the shock with those which play upon the axles.) The introduction within the hub, of springs, composed of blocks of India rubber to resist and destroy the shock and concussions caused by the rolling of the wheel on an uneven surface. The combination of discs with the box or axle, and other parts of the wheel for forming the spring chamber, and as a support to the wheel. Also a disc within the spring chamber, operated on by set screws from the exterior, for the purpose of regulating the elasticity of the spring, and for increasing or diminishing the space allowed for the lateral expansion of the spring.

James Ashworth, of Rochdale, Lancaster, manufacturer, and Thomas Mitchell, of the same place, manager. *For certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton, wool, and other fibrous materials.* Patent dated May 29, 1850.

Claims.—1. With reference to the machines commonly known as "billys," "jacks," and "mules," the application of a spring catch, with a hook-shaped recess formed therein for the purpose of detaining the carriage when run out.

2. The use of a wire or other instrument which detects the undue absence of a weft thread, by being brought into such a situation that the said thread shall loop upon it if in its proper position, but which, in conjunction with suitably-arranged apparatus, allows the loom to be stopped if the thread be absent.

3. The use of a motion obtained by connecting the yarn or the cloth with any suitable working part, for the purpose of governing the giving off of the warp or taking up of the cloth.

4. The use of an intermediate apparatus connecting the stop motion of looms to those parts by which the stopping is immediately effected, whether such stop motion be applied to the weft or warp threads, or consist simply of hand gear.

5. The application of a catch plaesd in connection with any suitable part of the apparatus used for stopping the loom, so arranged as to hold the slay, or an attachment thereto, when desired, in order to arrest the motion thereof.

Jonathan Harlow, of Birmingham. *For improvements in the manufacture of bedsteads and other articles for sitting or reclining on.* Patent dated May 30, 1850.

The improvements specified are—

1. Attaching parts of wrought iron joints to solid or tubular iron pillars or posts of bedsteads, by means of cast iron run in around them.

2. Fixing parts of wrought iron joints to side, head, or foot rails, tubular or solid, by welding.

3. Attaching parts of dovetailed joints to pillars or posts of bedsteads by soldering or brazing.

4. Attaching the fastenings of rails to the posts by forming them with a ring, which is heated and passed over or on the post—the cooling of the metal contracting it and making a secure fastening.

5. Applying ornaments to the head or foot ends of iron bedsteads. This has been hitherto done by casting ornaments on the iron itself; but ornaments of a bolder kind are now proposed to be applied by combining them with the wrought iron parts, and then finally securing the whole by other and additional castings.

6. The employment of eye pieces and castings to fasten the ends of bedsteads.

7. The construction and arrangement of stretchers, in which they are brought to a state of tension by means of screws, or of a system of levers.

8. The combination of wooden pillars or posts with metal rails.

No claims.

Edwyn John Jeffery Dixon, of the

Royal Slate Quarries, Bryntafood, near Bangor, North Wales. *For improvements in the manufacture of sinks and other articles of slate and stone.* Patent dated May 30, 1850.

The machinery employed by Mr. Dixon for reducing the rough blocks previous to their being manufactured, consists of a set of saws from 10 to 18 feet long, attached to the sides of a beam of 45 feet in length and 1 foot square, to which an alternating movement is communicated by suitable cranked gearing. This beam is supported on rollers which have their bearings on levers whose fulcrum is in the framing of the machine; it is also guided laterally by rollers longer than the beam is deep. Connected to each of the free ends of the levers is a rod, the upper end of which is attached to a second lever, on which slides a counterweight: this serves to balance the saw beam, and by adjusting this weight, the saws may be raised to admit the blocks of stone, and their pressure on the stone while cutting may also be regulated at pleasure. A pipe furnished with cocks runs the length of the beam, and supplies water to the saws, which may be either toothed or plain, in which latter case, however, sand is requisite to assist their cutting. A modification of this machine consists in making the bed moveable, and this is more particularly adapted to the sawing of large blocks.

Another form of machine is described, in which a circular saw is employed; this saw is keyed on a shaft, which is so centred as to be capable of moving in a circular orbit, thus affording great facilities for cutting blocks which are not easily moved.

When the blocks have been reduced to a proper size, they are submitted to the operation of hollowing out the trough, in case sinks are desired to be made. This is effected by means of cutters screwed or keyed into a box on the end of a revolving shaft—the stone being brought up to them on a bed moved by a winch.

A machine is next described for rebating stone for various purposes, such as to receive gratings, &c. After this we have descriptions of improved slate ridges for roofs, constructed of three pieces, two placed at an angle covered by the third piece;—of a method of securing sinks in pavement, and also the paving slabs to each other, which consists in sinking corresponding curfs in the abutting ends and sides of the slabs, into which are introduced small plates of metal, whereby an even surface of the pavement is effectually secured;—of a method of forming chimney tops, in which an ornamental metal ring serves to secure one end of the chimney pot, composed of four slabs of slate, while the lower end is bound together with hoop iron until embedded in the masonry of the chimney it is intended to surmount. Lastly, Mr. Dixon specifies an improvement in the construction of the tops of washstands, which consists in adapting to the rebate on which the edges of the bason rest a ring or washer of gutta percha or India rubber; and in copying and napkin or linen presses, in which the pressure is effected by raising the plate of stone on which are laid the articles requiring compression. The upper plate of napkin presses is hollowed out and filled with water, which, by keeping the under surface of the plate damp is stated to be of advantage.

No claims.

Guillaume Ferdinand de Douhet, of Clermont, Ferrand, France, gentleman. *For improvements in the disoxygenation of certain bodies, and the application, separately or simultaneously, of the products therefrom to various useful purposes.* Patent dated June 1, 1850.

Claims.—1. The fabrication of hydrosulphurets by the disoxygenation of various sulphates, either by means of the humid or the dry process.

2. The application of the hydrosulphurets of soda, potash, and ammonia to the washing and cleansing of woollen and other fabrics, and of the two first-named products to the manufacture of soap, and of artificial soda and potash.

3. The manufacture of colours suitable for oil, varnish, and spirit of turpentine painting by the disoxygenation of metallic sulphates and their decomposition, by means of soluble hydrosulphurets, such as those of soda, potash, and ammonia, or insoluble hydrosulphurets, such as those of barium, strontium, and calcium.

4. The employment for the purpose of water-painting, of colours produced by the disoxygenating process, and having a double alkaline and metallic base.

5. The application of the hydrosulphurets of barium, strontium, and calcium, in combination with white oxide of zinc, to be employed as a paint.

Thomas Page, of Middle Scotland-yard, Middlesex, civil engineer. *For improvements in the construction and means of cleansing sewers.* Patent dated June 1, 1850.

Mr. Page proposes to construct a reservoir, in connection with a sewer, at such a height as to be filled at high water. A set of tubes or culverts pass from the sewer under this reservoir to the place of discharge, which must be above low-water mark. These culverts have flush gates at each end, and communicate also by flush gates with the

water reservoir above them. Supposing now the culverts to be full of sewage, all the flush gates to be closed, and the high tide to have filled the water reservóir, and that, about an hour after high water, it is desired to empty the culverts—by opening the communication between the reservoir and culverts, and the flush gates of the latter, the water in the reservoir will descend and force out the sewage contained in them with a velocity which would overcome the resistance of the tide, and be proportionate to the head of water in the reservoir. On opening the communication between the main sewer and the culverts, the pressure would be sufficient to displace the water and refill the culverts with sewage ready to be emptied at the return of tide. The water reservoir may, of course, be supplied from a spring or other convenient source, instead of from the river or sea into which the sewer discharges itself.

Claim.—The arrangement and combination of parts by means of which sewers may be emptied and cleansed at any time of tide without mechanical assistance other than is afforded by the varying level of the water itself.

Ezra Jenks Coates, of Bread-street, Cheapside, London, merchant. *For improvements in the manufacture of bolts, spikes, and nails.* (Partly a communication.) Patent dated June 1, 1850.

By the employment of a machine described by Mr. Coates, nails, &c., may (it is said) be produced from the commonest strip or fender iron, fully equal to the best of those manufactured by hand-hammering. The iron is fed into the machine, at a white heat, in plates an eighth of an inch shorter than the desired nail or bolt, and the plates are then rolled in the direction of their grain. No claims.

Moses Poole, of London, gentleman. *For improvements in machinery for punching metals, and in the construction of springs for carriages and other uses.* (A communication.) Patent dated June 1, 1850.

The "improvements in machinery for punching metals" are exemplified by an "anti-friction press," the power of which is applied by means of a lever carrying at one extremity a roller working between two eccentric sectors, the upper one of which, terminating in an acute angle (as they both do), bears against a pivot bolted to the framing. whilst the lower sector rests on the follower of the press, which is enclosed in a helical spring, which causes it to rise after each stroke of the machine. The amount of traverse up and down is regulated by the eccentricity of the faces of the sectors. A greater amount of traverse may be secured by employing two eccentric rollers and sectors whose faces are circular instead of eccentric.

Under this head of his specification Mr. Poole claims—

1. The employment of a roller and eccentric sectors, operated on in the manner described.

2. The employment of an eccentric roller, or of two eccentric rollers, and sectors of circular instead of eccentric form.

The improvements in the "springs for carriages" consist in bending a strip of metal into various curves, the ends of the strip being welded, brazed, or otherwise secured to the body of the spring. The advantage of this construction of spring is, that the vibrations caused by pressure, instead of passing out at the ends, as is the case with springs of ordinary construction, pass through the curves, and arriving at their ends, are caused to react continuously, with intensity varying with the amount of pressure applied.

Claims.—The manufacture of springs, by causing strips of metal to be bent into the form of curves, the ends terminating upon, and being attached to, the body of the metal.

Arthur Elliott, machine maker, of Manchester, and Henry Heys, of the same place, book-keeper. *For certain improvements in machinery for manufacturing woven fabrics.* Patent dated June 1, 1850.

Messrs. Elliott and Heys' first improvement consists in the application to the slay or lathe swords of looms, of a rod of metal or wood, connecting the two, and furnished with cross pins of metal or wood, perfectly smooth, and placed an inch or two apart; the object of this arrangement being to prevent the shuttle flying off the race in its rapid movements to and fro. A second improvement consists in providing the shuttle-box with a steel spring, which may be either with or without swell, and which prevents the shuttle from rebounding when it has passed into the box. A third improvement is the addition to the trapping motion of looms of a stop or clip, which, on the spring-catch of the frog being raised by the stop-finger rod, rises simultaneously therewith, and by clipping the finger-rod prevents it from slipping, and thus perfects the action of the catch.

Claims.—The arrangement and construction of apparatus described, or any mere modification thereof, for preventing the shuttle from flying off the race or trash-board.

2. The addition or improvements of a clip or stop to the trap motion, to prevent trapping in the shed.

3. An additional spring to the inside of the shuttle-box to prevent the shuttle from rebounding.

WEEKLY LIST OF NEW ENGLISH PATENTS.

John Platt, of Oldham, Lancaster, engineer, for certain improvements in machinery or apparatus for spinning and doubling cotton, and weaving cotton, flax, and other fibrous substances. December 2; six months.

Thomas Watson, of Rochdale, Lancaster, hat manufacturer, for improvements in the manufacture of hat plush, and also in machinery or apparatus employed in such manufacture. December 2; six months.

Richard Shiers, of Oldham, Lancaster, manufacturer, and James Heginbottom, of the same place, manager, for improvements in the manufacture of textile fabrics December 2; six months.

Julian Bernard, of Green-street, Grosvenor-square, gentleman, and Jean Baptiste Durenille, of 30, Cité de l'Etoile, Thermes, France, for improvements in the manufacture or production of boots and shoes, and in the materials and machinery or apparatus to be employed therein. December 4; six months.

Benjamin Hinley, of Birmingham, brassfounder, for improvements in the manufacture of castors. December 5; six months.

Joseph Alexander Franklinsky, of Stanhope-place, Middlesex, gentleman, for improvements in public carriages for the conveyance of passengers. December 5; six months.

Ewald Riepe, of Finsbury-square, London, merchant, for certain improvements in refining steel. December 5; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Nov. 27	2555	William Stidolph	Bath	The chiragon for teaching and enabling the blind to write.
28	2556	Thomas Dismore & Son	Clerkenwell-green	Spring bolt.
,,	2557	William Southam	Nuneaton	Self-acting millstone ventilator.
,,	2558	Joseph James Galt	Portsmouth	Cape.
,,	2559	Lincoln and Bennett	Sackville-street, Piccadilly	Ventilating hunting cap.
29	2560	Solomon Solomon	Commercial-place, City-road.	Marine balance time-keeper
,,	2561	Jacob Parker	Montpellier-avenue, Cheltenham.	Lady's railway portmanteau
,,	2562	Joseph Horatis Cutler.	Birmingham	Button.
,,	2563	Richard and Henry Williams	Ludgate-hill	Self-opening parasol.
30	2564	John Whitehead	Charlestown, Pendleton	Valve box and valves for the supply-pipes of steam engines.
,,	2565	Thomas Oldham	Manchester	Shirt.
Dec. 2	2566	John Baily	Mount-street, Grosvenor-square	Pheasant, poultry and cattle fountain.
,,	2567	Peter Rigby	Grove-street, Liverpool	Apparatus for burning spirits for the purpose of obtaining heat for portable cooking apparatus.
,,	2568	Alfred Clayton	Lymington, Hants, gun-maker	Tube for Colonel Hawker's new ignition.
3	2569	George Twigg	Birmingham	Dress fastener.
,,	2570	Thomas Oldham	Manchester	Shirt front.
,,	2571	Hargrave, Harrison and Co,	Wood-street, Cheapside	Parasol.

Errata in Mr. Bills's Article, Page 426.

Page 426, line 19 from the top, for "indices," read derivees.
,, 25 ,, "divisor," read derivee.
,, 30 ,, "congeric," read congeneric.
,, 32 ,, "join," read give.

Also, at line 5 from the bottom, suppress the comma after the word "only"; and at the foot of the page for "Newark-upon-Tyne," read Newark-upon-Trent.

CONTENTS OF THIS NUMBER.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1427.] SATURDAY, DECEMBER 14, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

BROWN'S PATENT STEAM ENGINE.

Fig. 1.

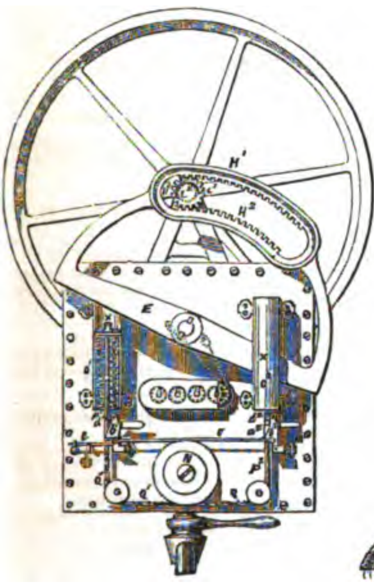


Fig. 4.

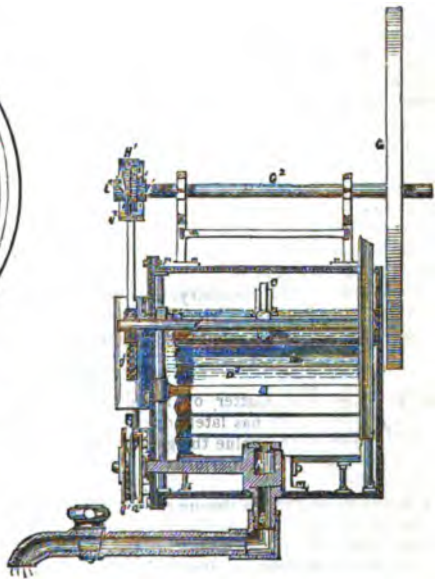


Fig. 2.

A

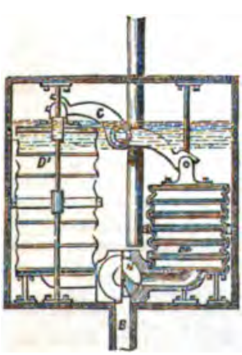


Fig. 3.

BROWN'S PATENT STEAM-ENGINE.

In our last volume, p. 73, we described some very ingenious fluid measuring and registering instruments invented by Mr. Samuel Brown, of Lambeth; and we have now before us the specification of some improvements in and additions to these instruments, which he has since patented, including the application of their system of action to motive machinery of various kinds. The prefixed engravings represent a steam engine on this plan, remarkable alike for its entire novelty, and for the reasonable promise which it offers of being a cheap and efficient prime mover. To understand clearly, however, how it acts, we must first describe the principal parts of one of Mr. Brown's fluid-measuring instruments, of which the steam engine may be said to be but a better application.

Fig. 5 is an elevation, and fig. 6 a vertical section of the fluid meter to which we refer. AA is a cistern or case, in which the measuring apparatus is placed. B is a vertical pipe by which the fluid to be measured is admitted into the case, and C a pipe through which it is drawn off. DD^1 are two collapsible measuring vessels; each of these vessels is composed of a vulcanised India rubber tube or cylinder kept distended by metal rings *bb*, and closed at top and bottom by solid metal plates or discs *aa*. At bottom, these collapsible measuring vessels are connected to the discharge pipe C, by means of a fourway cock E^1; the openings in which are so disposed that while the one vessel D is open to the discharge pipe C, for the purpose of allowing its contents to flow out, the other vessel D^1 has its communication open through the aperture *c* (of the fourway cock within the interior of the cistern or case A), for the purpose of allowing the fluid to flow into that vessel. E^2 is a beam which is centred upon the axis F, and is connected at its two ends to the upper disc *a*, of both measuring vessels, by means of the forked terminations dd^1, and the brackets GG^1, which are provided with friction rollers which work within the forked terminations dd^1.

By this arrangement, the upward movement of the upper disc of one vessel must always be accompanied by the downward movement of the upper disc of the other vessel; that is, while one is being emptied the other is being filled. The means of effecting the turning of the fourway cock at the proper interval to suit the emptying or filling of the vessels will be afterwards described. H is a cylinder or hollow beam which is centred upon an axis having its bearings in standards, or in the sides of the case A. I is a ball or globular weight which is placed inside the hollow beam H, or chamber in which the weight is of sufficient size to allow it to roll from one end of the beam to the other. KK^1, LL^1, are chains which connect the ends of the beam H with the beam E^2, and to a drum affixed to the plug of the fourway cock. As the apparatus is represented in the figure, the fluid is supposed to be passing out from the vessel D and into the vessel D^1. The top cap of the vessel D by its descent draws the chain K, which is passed over the pulley M, and thereby causes that end of the beam to which it is attached, to rise till it gets inclined in a reverse direction, whereupon the ball or weight I rolls to the other end of the beam, and gives it a sufficient degree of preponderance at that end to actuate, through the intervention of the chain L^1, the fourway cock, and allow the fluid to flow out from the vessel D^1, and into the vessel D. Each time the one vessel becomes filled, and the other emptied, a similar change is effected in the position of the fourway cock.

The horizontal ascent and descent of the upper discs *aa* of the measuring vessels are regulated by means of guides NN, which are affixed to the case A, and eye-pieces OO, placed upon the sides of the measuring vessels. The adjustment of the measurement of these vessels is effected by raising or lowering the pulleys MM, which is done by means of the nuts QQ. When these nuts are turned to the right, they screw up the rods by which the pulleys are suspended, and cause the reversal of the position of the beam H to take place sooner, and thereby lessen the range or capacity of the measuring vessels; by screwing the nuts QQ to the left, a reverse effect is produced, namely, an enlargement of the capacity of the measuring vessels. The registering part of the apparatus is connected to the axis of the beam E^2, and is shown in fig. 4. R is a small beam or double-armed lever, which is keyed upon the axle F, and carries two pauls SS, which take into the teeth of the ratchet wheel T, and thereby give motion to the wheelwork of the indicator, which marks the number of times the vessels DD^1 have been emptied, as also the quantity which has been taken from any one of them, which may happen to be partially emptied.

The steam engine, which, as we have intimated, is but an embodiment of this very philosophical contrivance—as represented in figs. 1, 2, 3, and 4. In the description that follows of this engine, water is, for the sake of uniformity, still

supposed to be the elementary power employed—but the intelligent reader will at once perceive that either steam or compressed air may be readily substituted for it.

Fig. 5.

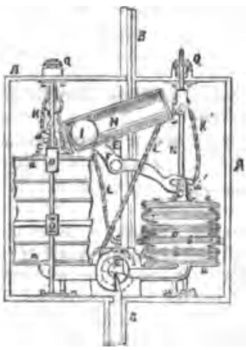


Fig. 4.

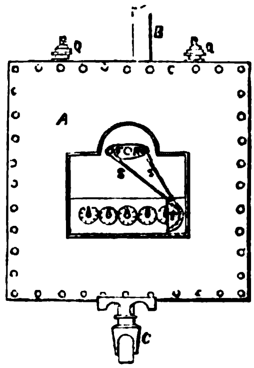


Fig. 1 is an elevation, fig. 2 a cross section, fig. 3 a plan, and fig. 4 a longitudinal section of an engine of this description, fitted with the requisites necessary for transferring its motion to other machinery. The interior arrangements and connections of the collapsible measuring vessels are similar to those described and represented in figs. 4 and 5, but differ in the means employed for turning the fourway cock, as will be afterwards explained. When water is employed for giving motion to this machinery, it is supposed to be taken from some source where there is a head of water, in which case its effective pressure available in giving motion to the machinery, will be proportionate to the height of the column of water so employed. A is the supply pipe, B the exit pipe, D^1 D^2 the collapsible vessels, and C the beam by which they are connected. E is another beam, which is keyed to the same axle F as the beam C, and, partaking of the same movements, gives motion to the fly-wheel G and its shaft G^2, through the intervention of the double segmental racks H^1 H^2 and the pinions I^1 I^2; which last are placed upon the shaft G^2, and are free to turn upon it. The teeth of the segmental rack H^1 gear into the pinion I^1, and those of H^2 into the pinion I^2; and the respective motions given to the pinions by these racks is transferred to the shaft G^2 by means of the pauls K^1 K^2, which are affixed to the pinions I^1 I^2 and the ratchet wheels L^1 L^2, which are keyed upon the shaft G^2. The motion thus given to the shaft G^2 may be applied for driving other machinery by means of wheel gearing, pulleys, or other such means as are now commonly employed for that purpose. The same beam E also gives motion to the ratchet wheel M, which works the train of wheels of the index for registering the quantity of fluid passed through the engine.

The arrangements before referred to, for giving motion to the fourway cock, N are as follows:—In figs. 6 and 7 the collapsible vessel D^1 is represented as discharging its contents, and D^2 as being filled; as D^1 gets empty, the beam E (the ends of which move in slots formed in the tubes x x, containing springs O^1 O^2) comes down, and thereby compresses the spring O^1, which depresses the rod P^1 till the cross pin a^1 comes against the inclined plane b^1, which causes it to move towards the right, and in so doing pushes the inclined plane b^2, also towards the right by means of a connecting rod C. This movement of the parts just described towards the right sets the cross pin a^2 upon the rod P^2 free from the grip of the detent or tumbler catch d^2, and the instant this takes place the spring O^2 pulls up the rod P^2 and the chain Q^2, which turns round the plug of the fourway cock, and allows the water now to flow into the vessel D^1 and out from D^2. The detents or tumbler catches d^1 d^2 freely allow the cross pins a^1 a^2 to go down past them, but prevent these pins from again ascending until the proper instant for the reversal of the posi-

tion of the fourway cock, which is effected in the manner just described. *e* is a counterbalance, which brings the inclined planes b^1 b^2 back to their original position. After having been pushed over, the action which takes place when the other end of the beam E descends, is followed by exactly the same set of movements, and thus keeps up a continuous action of the engine so long as the water is supplied from the head or reservoir.

SASH-BAR GROOVING MACHINE, INVENTED BY SIR SAMUEL BENTHAM AND REVIVED BY MR. PAXTON.

It is going the round of many newspapers, and other periodicals, that previously to the year 1837 there was no other machinery applicable to the making of sash-bars than a grooving machine—that Mr. Paxton improved upon that machine, so as to make the sash-bar complete, and that in the year 1841 the Society of Arts awarded him their medal for his machine. Now it must be known to readers of the *Mechanics' Magazine* that more than forty years before that time Sir Samuel Bentham had in use machinery for the same purpose; the Editor of that publication, in No. 1323, when giving an account of the trial "The Crown *v.* Smith," appended in a note, that "Sir Samuel Bentham was the first to introduce saw-mills into our naval arsenals, the first also to lay down the principles on which all sorts of machine sawing may be constructed, and which have never since been materially departed from. The specification of his patent, 28 April, 1793, is a perfect treatise on the subject," &c. Subsequently part of Sir Samuel's "Statement of Services" is quoted, and it is shown that, "besides the general operations of planing, rebating, morticing, sawing in curved, winding, and transverse directions," he invented an apparatus "for preparing *all parts of the highly-finished window sash.*" The "Statement of Services" was an official communication to the Secretary of the Admiralty in the year 1813; it was also printed, and copies of it put into the hands of the Lords of the Admiralty, and of several ministers of the Crown at that time, and was published by Longman and Co., 1828. This publication might be supposed to have rendered his inventions for cutting and shaping wood very generally known; undoubted, also, since in the instance of each statement the authority for it was given in the margin. Now however, that the merit of these inventions is so publicly attributed to others, it becomes due to Sir Samuel that evidence should be brought forward of the priority of his machines.

Sir Samuel's patents of November 26, 1791, and April 3, 1793, afford the earliest accessible evidence of his inventions for working wood.

An apparatus, according to those patents, was soon afterwards seen at work in Queen's-square-place, Westminster, —a fact sufficiently authenticated by the eulogium bestowed upon it in the House of Commons.

The next evidence is that of the proceedings of the Lords of the Admiralty, who having repeatedly visited that same machinery, perceived the advantages that would result from its use in the Royal Dockyards, and arranged with Sir Samuel that he should, with a view to its introduction, address a letter to their secretary, proposing a visit to those yards. He did so April 21, 1795, in the following terms:

"Sir,—Flattered by the satisfaction expressed by the Lords Commissioners of the Admiralty on viewing my system of machinery, by the wishes and expectations their Lordships seemed to entertain of its being found capable of being introduced with advantage in some of the works belonging to His Majesty's Dockyards * * * understanding, at the same time, that they seemed to think it might be of use if I were to make a visit to the yards," &c.

That letter was honoured the very next day (April 22) with a reply; not, as customary, through their secretary, but by the Lords of the Admiralty themselves. It commenced thus:

"Sir,—Having taking into our consideration your letter to our secretary, wherein you propose to undertake a visit to the dockyards in order to form a judgment of the instances in which any parts of *your machinery* might be introduced with advantage," &c.

This letter informed him that orders had been given for his admission to the

several yards, &c., and after desiring him to report his observations to them, their Lordships concluded by saying:

"We are, Sir,
"Your most humble Servants,
"SPENCER, ARDEN, CHARLES SMALL PYBUS, CHARLES MIDDLETON, H. SEYMOUR, PHIL. STEPHENS, S. GAMBIER.
"Brigadier-General Bentham."

The above signatures were those of the First Lord, and of *all* the other Lords of the Admiralty.

In consequence of Sir Samuel's subsequent observations, the introduction of his machinery, and of a steam engine to give motion to it, was determined on by the Admiralty, but the Navy Board and the Dockyard Officers professing fears that a steam engine would set a dockyard on fire (!!!) and they being clamorous against the employment of machinery, the measure was postponed till some favourable incident should occur; accordingly, in the year 1797, Sir Samuel availed himself of the need for new and powerful pumps at Portsmouth, and proposed then, 21st December, 1797, that they should be worked by a steam engine, and took that opportunity of *smuggling in*, it may be said, machinery for cutting and shaping wood. That part of his letter which proposed the machinery he considered it desirable to introduce, in the first instance, he particularized as follows:—

"1st. By means of reciprocating motion."

"Sawing in general; particularly straight work—such as siding timber, slitting deals, cutting, quartering, and straight planks of all kinds."

In the margin of a certified copy of this letter is written, "All introduced except siding timber."

To return to the proposal.

"2ndly. By means of rotary motion."

"Edging, tongueing, and grooving, rebating, and cross-cutting into lengths, deals of all sorts for *joiners and house-carpenters' work*."

Against this article is written in the margin, perhaps as late as 1813, "Long since introduced with great success."

Then follows in the proposal,

"Tongueing and grooving piles for dam-work."

"Converting slabs and offal timber into treenails."

This also was executed, so that slab and offal theretofore sold mostly for fire-wood, was by means of his machinery made available for the fabrication of various articles of secondary importance.

To the above particulars, Sir Samuel added, "These, amongst various other instances, have occurred to me as giving occasion in his Majesty's dockyards for the substitution of the *invariable accuracy of machinery*, to the uncertain dexterity of more expensive manual labour."

"Invariable accuracy" is an advantage of machinery rarely adverted to, though of pre-eminent importance. It is from that invariable accuracy that the Crystal Palace is being put together with such extraordinary expedition. In all minor works the importance of that accuracy is equally great in point of appearance of the finished work, of economy of time and money, and of durability. By Sir Samuel's machinery junctures were as accurately cut as any other post—even dovetails, mortices and tenons.

The original of this letter, 1797, doubtless is amongst records at the Admiralty; there is a copy of it in the books of the Inspector-General's-office, and a certified copy exists in private hands.

Several of Sir Samuel's machines were inspected by the Lords of the Admiralty in Portsmouth yard on the occasion of their visitation of the Dockyards in 1802, as may be seen in their "Minutes of proceedings."

Amongst the machinery for working wood, iron, &c., proposed by Sir Samuel, 1812, for Sheerness Dockyard, most of the above-mentioned machines were specified, as also "for cutting timber and plank *curved* as well as straight." That proposal, though altogether uninvestigated by any naval authority, was published, and may be seen in "Naval Papers, No. 4." A few years ago, however, a machine for cutting curved timber has been employed in Woolwich yard; doubtless not without remuneration to the introducer of it; if so, an expense has been unnecessarily incurred, since the machine for the same purpose, described in Sir Samuel's patent, has long been public property, and a working

model of it was amongst the articles exhibited at Birmingham.

Many other items of evidence might be extracted from Sir Samuel's official correspondence, but the above particulars may be considered as sufficient.

In conclusion; it must be added, that although machinery for forming the entire of sash-bars had been so long actually in use, yet it seems to have been unknown to Mr. Paxton, and therefore he may be regarded in the light of a re-inventor of it. Yet it seems remarkable, considering the multitudes who visited the Wood-mills at Portsmouth, that Sir Samuel's machinery should have been unknown to manufacturers, and to the Society of Arts—extraordinary that no one for profit-sake should have availed himself of the examples there so publicly exhibited; not to speak of the descriptions of machinery contained in Sir Samuel's patents and farther made public by the "Repertory of Arts," and other scientific journals.

M. S. B.

THE EARL OF DUNDONALD'S BOILER.

Fig. 1.

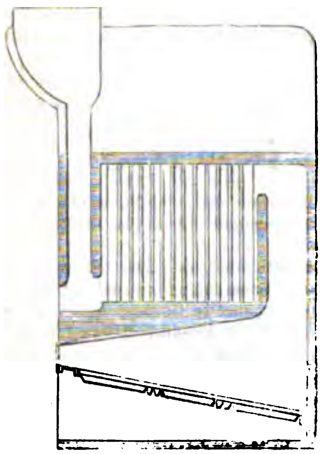


Fig. 2.

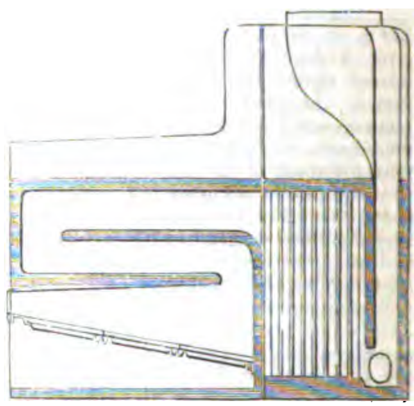
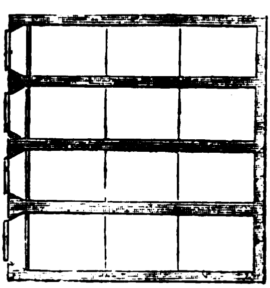
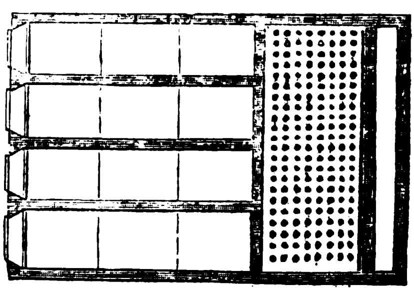


Fig. 1a.





In a recent Number of our Journal we extracted from the *Franklin Journal* an article on the improved form of steam boiler, introduced with such remarkable success into the new American ocean steamers of the Collins line, in which the writer has been at honourable pains to show, that the merit of its invention belongs, not to any of his own countrymen, but to the English Earl of Dundonald. We have now before us a pamphlet by Mr. Amherst H. Renton,

C.E. (printed for private circulation), from which it appears that the American copy is, after all, but an imperfect one taken from the Earl's English specification, and that the boiler has since undergone several improvements, which have had the effect of very considerably increasing its efficiency. Our transatlantic friends will feel obliged to Mr. Renton for putting it in our power to place before them an authentic account of the invention in its best and latest form; and so also will our engineering readers generally—for, according to all present appearances, there is no better boiler than this in the field. Mr. Renton devotes a preliminary chapter to a review of the progress of improvements in the marine steam engine down to the present day; and then enters on the main subject of his pamphlet in the following terms. Where the author uses the words "patent boiler," we have, for the sake of greater clearness, substituted "The Dundonald Boiler." The engravings referred to are (fig. 1 and 1[a]), a section and plan of a boiler of this kind, constructed to occupy the space allotted to the furnaces, which is the minimum space that a boiler can be placed in; and (fig. 2) a section of a patent marine boiler of less altitude than fig. 1—the tube-chamber being arranged behind the furnace.

Extract.

The necessity of an important reduction in the consumption of fuel for marine engines, in order to effect the extension of voyages, and afford the Royal Marine, especially, the means of prolonging cruises, without the necessity of frequent returns to port for the purpose of replenishing their coal store, led Vice-Admiral the Earl of Dundonald (whose attention has for many years been directed to this subject) to the consideration of the means by which these objects would be accomplished. His Lordship having succeeded in producing a new and improved construction of tubular boiler, obtained a patent for his invention.

The success which has attended the patent boiler on a large scale, has fully realized the anticipations formed of its value: and the Government records of numerous trials, which were authorized with a view to determine its comparative merit, exhibit results greatly exceeding those of the most carefully-conducted experiments with boilers of ordinary forms and of approved construction, although, in many instances made with almost the nicety of laboratory practice. In several cases where the economical principle of firing, and the same proportions of heating surface, had been adopted in the ordinary boiler, the complete verification of the previously recorded extraordinary performances of the patent boiler was most strikingly evinced.

From the peculiar character of this boiler the outer surface of the tubes is liable to incrustation, and does not admit of being readily cleansed; which not only causes them to burn out quickly, but increases the consumption of fuel incident to a corroded surface. It may also be remarked, that the horizontal tubular surface made use of in this boiler is the most disadvantageous, as the lower part, amounting to a serious proportion of the whole, is of trifling value.

Great loss is also experienced by the frequent repairs to which these boilers are subject, more especially when not in constant use; the tubes being thin, are rapidly destroyed by the drops of liquid which fall from the domes of the steam chests, the corroding power of which is so great as to pierce with holes the upper surface of the tubes on which they fall.

This important result has been effected by a judicious arrangement of the heating surfaces (being a combination of the flue and tubular boilers,) by the substitution of a less destructive system of firing, and by the introduction of an inverted bridge, which is denominated "the Economical Heat Trap," by which the heated products of combustion are retained in contact with the most efficient part of the heating surface of the boiler, until the complete absorption of all the useful caloric is effected. In most, if not in all other marine boilers, the escape of heat into the funnel is not only permitted, but actually encouraged by every possible facility, and especially in those more recently introduced on the principle of the locomotive boiler, a form and construction most attractive from its apparent simplicity and compactness.

It is this retention of available power, in the form of caloric (now permitted unrestrictedly to escape into the atmosphere,) that in a greater or less degree constitutes the economy of a boiler. Such retention is effected by the relative principle of levity which heat possesses, in contradistinction to the gravity of heavy fluids. The natural tendency of heated air is to ascend, and only to descend when deprived of its caloric, or principle of levity. In the ordinary boiler the heated air has a free and uninterrupted ascent to the funnel; but in the patent boiler, it is conveyed through the flues to the summit of the tube-chamber, and there

constrained to maintain that elevated position by its levity, until the water has effectually absorbed all the useful caloric held in combination, and the products of combustion, deprived of their superabundant principle of levity, descend to the interior aperture leading to the funnel, where they escape into the atmosphere at a low temperature. A very prominent feature in the economical boiler is the adoption of vertical tubes, through which the water, and not the fire, circulates. The advantages resulting from this arrangement are manifold.

Firstly.—The circulation of the water in the tubes is a maximum, and therefore induces the greatest amount of heating power by their surfaces, the maximum differences of temperature being preserved between the heated air in the tube-chamber and the water in the tubes.

Secondly.—A greater body of heated air is maintained in the tube-chamber or flue, the interstices between the tubes being much greater than the interior capacity of the tubes. The evaporating surface is thus preserved in a more uniform bath of heat, and of less fluctuating temperature.

Thirdly.—From the vertical position of the tubes, the steam generated from the heating surface readily escapes as soon as formed, giving a powerful impetus to the circulation of the water. The whole of the surface also is rendered available, while in the locomotive tubular marine boilers,* from the horizontal position of the tubes, the lower portion is only partially effective.

Fourthly.—The velocity of the heated air being diminished in the tube-chamber, affords time to impart its caloric more perfectly to the tubes, instead of passing rapidly over the heating surface, as in the ordinary tubular boiler.

Fifthly.—The heat being less intense in the tube-chamber, the tubes may be of thinner metal, whereby the full effect of the fuel will be obtained, and the tubes themselves are preserved from the injurious fluctuations attending high temperature: high temperature being more seriously destructive of a boiler from the difficulty of uniformly maintaining it, whilst the material is subjected to all the evils resulting from continual changes of temperature.

Sixthly.—The constrained descent of the products of combustion in the tube-chamber with a diminishing temperature, being in opposition to the ascending current of water in the tubes with an increasing temperature, produces a more uniform affinity in the water for caloric, and therefore maintains greater uniformity in the differences of temperature which constitute the absorbing or heating power of a boiler.

Seventhly.—The reduction of the quantity and weight of water, from the interior of the tubes having less capacity than the interstices.

Eighthly.—The tubes are effectually preserved from corrosion by the rapidity of the circulation.

Ninthly.—If from any accidental circumstance, such as neglect in blowing off, &c., the tubes shall have become corroded in a slight degree, they can each separately, and all more readily be scaled; a difficulty, with other tubular boilers, hitherto insurmountable.

Tenthly.—Every facility is obtained for cleansing the tube-chamber from deposited soot or ashes (which experience has shown to be trifling,) the greater portion lodging in the receptacle provided for the purpose at the foot of the uptake, from whence it is easily withdrawn.

Eleventhly.—The present destructive system of firing, as now used in marine boilers, is superseded in the (Dundonald) boiler by a useful and moderate system of firing, alike beneficial to the boilers, the service, and the stokers; to the boilers, by subjecting them to less intensity of heat, with all the attendant evil consequences: to the service, by effecting a material saving in the cost of fuel and maintenance of boilers: and to the stokers, by requiring less labour to maintain the full action of the boilers.

Twelfthly.—From the superior evaporative power of the (Dundonald) boiler, it may be made of less weight and cost than any other boiler of equal power and efficiency.

Thirteenthly.—When the (Dundonald) boilers are constructed for economical evaporation, the additional surface and weight are compensated by rendering it unnecessary to embark an amount of coal more than equivalent to such additional weight; for instance, if a vessel now embarks 300 tons of fuel to perform a certain voyage, the same voyage may be performed by less than 200 tons; the economy arising therefrom will be a third of the whole cost of fuel, whilst the durability of the boilers will be increased in the well-known inverse ratio of the decomposition of the materials, under intense or under moderate firing: in fact, the whole

* The tubular boiler, with which the (Dundonald) boiler stands more prominently in contrast in this paper, is denominated the Locomotive Tubular Marine Boiler in contradistinction to other forms of Tubular Marine Boilers, and is that adopted by the Government for the use of the British Navy; and which has also, with few exceptions, superseded all others in the Commercial Marine of this and all other countries. The preference thus given to it fully confirming the high estimation in which it is held as the best boiler in use.

cost of new boilers may be perpetually obtained from the saving produced, pending the duration of ordinary boilers; leaving an additional gain of one-half the full amount, if the durability of the (Dundonald) boiler is in the ratio of the diminished heat to which it is exposed. In proof of this fact, tubular boilers, now in use, are caused to perform their quota of evaporation by 9 feet of evaporating surface per cubic foot of water evaporated, when it is proved, by the annexed Tables, that it required 19½ feet, by such a boiler, to arrive at the economy produced by the (Dundonald) boiler with 13½ feet. It will hereby be manifest, that if economy of space and weight be preferred to economy of fuel, the (Dundonald) boilers can be supplied of less weight, less magnitudes and less cost, than any common ordinary boiler. As it is desirable in marine boilers, that the furnaces, which are the most vulnerable parts, should be detached from the body of the boiler, greater facility is afforded in the (Dundonald) boilers for making them in sections, distinct from the tube-chambers, so that they can be removed when destroyed, and be replaced by a perfect furnace, without interfering with the body of the boiler, and its numerous connections with the engines. One or more spare furnaces may be taken on board, to be substituted for a defective one, in case of emergency, and further repair effected at leisure. In steam-vessels where altitude is not objectionable, the patent boiler may be constructed to occupy the minimum space, viz., that which is allotted to the furnaces, which is the least space that a boiler can be placed in; and when they are required to be out of shot way, they can be made in the height of the furnaces, and to occupy a minimum space under those circumstances.

In order to test the respective merits of the (Dundonald) boiler with others in general use in the naval service, it was suggested to the Lords Commissioners of the Admiralty, that their Lordships should be pleased to order a trial to be made under the superintendence of their own officers, that the usual objections urged against private experiments might be obviated; and their Lordships did accordingly institute a series of experiments with a Dundonald's boiler,* capable of evaporating 320 cubic feet of water per hour by an economical system of firing, and also by other boilers on the flue and locomotive tubular principle now used in the service. The results and inferences therefrom will be noticed in a succeeding page; but with a view to illustrate more fully the striking superiority of the patent boiler, the following evidences of existing practice up to the period of the introduction of the Dundonald boiler are adduced.

At the time when this boiler was produced, reference was made to the Government authorities, who stated the "average consumption of fuel in the naval service, under favourable circumstances, to be 8 lbs. per horse power per hour; and when the coals were bad, and boilers out of order, it comes up to 10, and even 12 lbs. per hour; and there was no reason to think that the consumption in tubular boilers materially differed from that in common boilers."

The term "horse power" is indefinite, but the rates of effect according to the above statement, will be from 7·8—6·25 and 5·2 to 5·8—4·69 and 3·9 lbs. of water evaporated for each pound of coal, according as the standard of a horse power is taken as 1 cubic foot or ·75 of a cubic foot of water evaporated per hour; the latter when the expansive power of the steam is moderately used; but in some engines where the expansive principle is carried out to the extent of ·625, or even ·6 of a cubic foot of water per horse power per hour, the above proportion of fuel per horse power becomes more extravagant. The vagueness of the term "horse power," as applied to the evaporative power of a boiler, is therefore obvious.

The various results which have been obtained by esteemed experiments (including the French) on a great variety of boilers, range between 7·25 lbs. and 9·25 lbs. of water vaporized by each pound of fuel consumed, the latter being the highest result of a marine boiler. The most favourable results that have been obtained with the famed boilers of Cornwall (where there is no limitation either to surface or dimension) are recorded in a very elaborate paper on the subject of boilers, by Mr. Parkes, in which the maximum effect obtained was 11·82 lbs. of water from 1 lb. of coal, by a slow rate of combustion; but this is obtained at a great sacrifice of weight and space.

These results being in conformity with experiments carefully and judiciously made by engineers of the highest credit, justified the opinion entertained of the patent boiler, and fully substantiated the records of its high evaporative qualities. The value of it was further corroborated when the same principle of slow combustion was successfully applied to the locomotive tubular marine boiler, by which its evaporative effect was raised considerably, though at the expense of its evaporating power.

* This boiler is equivalent to 420 cubic feet with the usual system of firing adapted at sea, or fully 560-horses power using the steam expansively.

When the importance of the economy of fuel is considered, it is a matter of surprise that it should have been so long neglected, to the great detriment of steam navigation, and that a system of firing so prejudicial in its consequences could have been so firmly persevered in, except from want of competent knowledge in those whose interests are concerned. The great evil in all our steam vessels is the limited capability of carrying fuel for long voyages—a fact deserving the serious consideration of all parties concerned in steam navigation, but to the royal marine of vital importance, inasmuch as the public interests depending on that service are of more consequence than any other.

The conclusions which arise from the full consideration of this subject, and which are amply corroborated by an inspection of the annexed official Tables of results, are, first, that the ordinary practice of using fuel on board steam vessels is wasteful, and highly destructive of the boilers.

The best recorded results have been already stated to be 7 to 9½ lbs. of water evaporated with 1 lb. of fuel, and this was considered a satisfactory result. The consumption of fuel is stated in weight of water evaporated, as the term horse power is a varying conventional measure, depending upon the economy with which the steam is disposed of in the engine, and can convey no adequate idea of the evaporative power of a boiler, having reference only to the engine as a whole.

By experiments made on the 8th and 9th of October, 1844, the power of marine boilers was fully proved by trials in Woolwich Dockyard on a locomotive tubular marine boiler of the usual proportions of fire and heating surface, and of the most approved kind then used by the Government, and on a common flue boiler on the 17th. as shown in the following Table:*

No. I.

Date.	Cubic Feet of Water Evaporated per Hour.	Pounds of Water Evaporated with 1 lb. of Coal.
Oct. 8	105·06	9·183
„ 9	110·76	8·584
„ 17	65·69	8·733

Secondly,—that an improved method of using fuel on board steam vessels is practicable, by which great benefit will accrue, both by the saving of fuel so effected and by the superior durability of boilers.

* This and the two following Tables are extracted from the Official Table of Results in possession of the Admiralty, as given at the end.

The trials of the Dundonald boiler, in November, 1844, succeeding the foregoing, were productive from 11·96 to 12·901 lbs. of water evaporated by 1 lb. of fuel, being 40 per cent. greater than the locomotive tubular marine boiler; the latter result, 12·901, being the maximum effect, as far as the trials were then prosecuted, as shown in the following Table:

No II.

Date.	Cubic Feet of Water Evaporated per Hour.	Pounds of Water Evaporated with 1 lb. of Coal.
Nov. 5	314	12·901
„ 6	306	12·483
„ 7	290	11·96
„ 8	233	12·127

Thirdly.—That a material saving of fuel is not incompatible with the efficiency of the Dundonald boiler.

The minimum amount of evaporation at the trials of the Dundonald boiler produced an effect of 12·127 lbs. of water evaporated with 1 lb. of fuel, an effect fully 40 per cent. greater than the best ordinary practice, and 30 per cent. more than the best result of the locomotive tubular marine boiler. (See Tables I. and II.)

The maximum amount of evaporation of the Dundonald boiler (being nearly 50 per cent. above the minimum) produced an effect of 12·901 lbs. of water evaporated with 1 lb. of fuel, or 50 per cent. greater than the best ordinary practice, and 40 per cent. greater than the best result of the locomotive tubular marine boiler. (See Tables I. and II.)

The economy is not, therefore, injuriously effected by increasing the evaporative power of the Dundonald boiler.

Fourthly.—That the favourable results obtained from the Dundonald boiler are due to the peculiarity of its construction.

In the trials of the Dundonald boiler on November 5, and that subsequently made with the locomotive tubular marine boiler, on November 26, on the same principle of economical firing, the maximum effect of the former was obtained by 13·67 superficial feet of heating surface for each cubic foot of water evaporated per hour, and that of the latter by 19·19 superficial feet of heating surface for each cubic foot of water evaporated per hour; the proportionate surface of fire grate per cubic foot of water being respectively ·477 and ·472 of a superficial foot, and the quantity of fuel burnt on each superficial foot of fire grate, being respectively 10·13 and 10·34, as shown in the following Table:

RESULTS OF EXPERIMENTS MADE ON THE EVAPORATING POWER OF MARINE BOILERS.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Date of the Trial.	Duration of Trials.	Number of Furnaces.	Dimensions of the Furnaces.	Total Surface of Furnace Grates.	Bar Surface per cubic foot Evaporated per hour.	Kinds of Coals used in the Experiments.	Quantity of Coal used.	Quantity of Water Evaporated.	Ratio of effect at Temperature of the Feed Water.	Ratio of effect with the Feed Water at 100°.	Evaporation per hour in cubic feet with the Feed Water at 100°.	Ratio of effect in proportion to the Grate Surface.	Coals burnt per sq. ft. of the Fire Grate during the Evaporation.	Coals burnt per square foot per hour.	Temperature of the Water supplied to the Boiler.	Total evaporating surface in the Boiler in square feet.	Evaporating surface for each cubic foot of Water evaporated per hour.	
On a Tubular Boiler made and tried in Woolwich Dockyard.																		
1844	H. M.		Ft. In. Ft. In.	Sq. Ft.			Lbs.	Lbs.			Cub. Ft.		Lbs.	Lbs.	o	Sq. Ft.	Feet.	These Trials were made with one boiler.
Oct. 8	6 30	3	8 0 x 2 2	52	·515	Welch Coal. Leur's Merthyr	4648	41040	8·83	9·183	105·063	8·83:1	89·38	13·75	56	1057	10 06	
„ 9	5 50	„	„	„	·489	Wood's „	4704	38760	8·94	8·584	110·759	8·384:1	90·46	15·51	54	„	9 54	
„ 17	8 6	„	„	„	·825	„ „	3808	31920	8·382	8·733	65·689	14·145:1	73·23	9·04	„	„	16·00	
On Lord Dundonald's Tubular Boilers of the "Janus," in Chatham Dockyard.																		
Nov. 5	6 0	6	6 0 x 2 1	75	·5	Llangennech.	4538	56277·5	12·34	12·901	314*	12·34:1	60·77	10·13	Average 50.	1073	13·67	Two only of the four Boilers were used in these Trials.
„ 6	„ „	6	6 0 x 2 1	„	·51		4600	54920·5	11·94	12·483	306	12·597:1	61·33	10·22		„	14·02	
„ 7	„ „	6	5 0 x 2 1	62·5	·437		4700	53770	11·44	11·96	300	10 769:1	75·2	12 53		„	14·28	
„ 8	„ „	4	2 of 6 0 x 2 1 2 of 5 0 x 2 1	45·83	·411		3600	41784·5	11·6	12·127	233	10·14:1	78·55	13·1		„	18·42	
Second Series, on a Tubular Boiler in Woolwich Dockyard, with the proportions & rate of Firing approximating to those of Lord Dundonald's Boiler.																		
Nov. 15	2 58	3	5 3 x 2 2	34·125	·546	Woods Merthyr	1176	11400	9·694	10·108	65·209	9·362	34·46	11·81	53	1057	16·22	These Trials were made with one Boiler.
„ 16	6 20	„	„	„	·658	Leurs Merthyr	1904	20520	10·777	11·228	54·008	11·282	55·77	8·81	54	„	19·57	
„ 19	6 24	„	„	„	·409	„	2576	27360	10·621	11·075	71·322	8·556	75·49	11·79	53	„	14·82	
„ 21	5 55	„	4 0 x 2 2	26	·351	Hand Picked „	2632	27360	10·395	10·868	77·351	6·018	101·23	17·11	50	„	13·66	
„ 25	5 58	„	8 0 x 2 2	52	·773	„	2352	25080	10·663	10·177	70·494	13·254	45·23	7·58	47	„	14·99	
„ 26	4 10	„	4 0 x 2 2	26	·495	„	1120	13680	12·214	12·802	55·062	8·487	43·08	10·34	„	„	19·19	

* Common Flue Boiler.

No. III.

Date.	Cubic Feet of Water Evaporated per Hour.	Feet of Firebar per Cubic Foot Evaporated.	Coal Burnt per Square Foot of Grate.
Nov. 5	78·5	·477	10·13
" 26	55·062	·472	10·34

In conclusion, it is scarcely necessary to recapitulate the comparative results exhibited by the extracts from the Tables, which are so apparent as not to need further comment; but for more convenient reference the prominent points may be summed up in a few words, viz., that for equal heating surface, equal surface of fire grate per cubic foot of water evaporated per hour, equal quantities of fuel burnt on each square foot of fire grate, and nearly equal effect in quantity of water evaporated for a pound of coal, the advantage obtained by the use of the Dundonald boiler over that with which it stands contrasted (the best in use), is in the ratio of 78·5 to 55·062, or 42 per cent. in favour of the Dundonald boiler. The amount of heating surface for like effects obtained, was in the Dundonald boiler 13·67 superficial feet for each cubic foot of water evaporated per hour, and in the locomotive tubular marine boiler, 19·19 superficial feet, or upwards of 40 per cent. in favour of the former; likewise the rate of heating surface to fire grate surface on the Dundonald boiler was 28·7 to 1, and in the locomotive tubular marine boiler, 40·65 to 1, or 42 per cent. in favour of the Dundonald boiler.

The value of the principle upon which the patent boiler is constructed is thus shown most incontestibly, proving that it is possible to obtain the maximum effect from the fuel consumed without diminishing the evaporative power of the boiler, which was found necessary with the locomotive tubular marine boiler, in order to obtain an equally favourable result, as appears from the Tables of the daily trials.

The Dundonald boiler, though prominently noticed as applicable to steam vessels, for which it is so admirably adapted and is so imperatively called for, is, nevertheless, as profitably applied to land engines.

The same success has attended the application of the principle both to high and low-pressure boilers, with powers varying from 10 to 30, 60, 100, and 150 horses.

Boilers of the last-named power have been constructed by Messrs. C. Robinson and Son (late Bramahs), engineers, Pimlico, under the patentee's exclusive license, for the Russian Imperial Navy; and the eminent machinists of the United States (ever on the watch for the most useful and practically advantageous inventions) have adopted them on board their new line of mail steam vessels to this country, although they have not availed themselves of the best construction, and consequently have not derived the full economy afforded by the principle. In their plan of construction the tubes are too small in the bore, and arranged too close to the furnace, whereby they are exposed to the intense action of the fires—a mode of construction scrupulously avoided in those boilers which are manufactured in this country. The heat-trap, or inverted bridge, which exercises so marked an influence on the consumption of fuel, is also most injudiciously applied.

Such is the extraordinary effect of this simple contrivance, when properly constructed, that in no case, with the most rapid firing, does any of the effective heat of the fuel pass beyond it into the funnel or chimney.

THE HOT-AIR CASK-CLEANSING PROCESS.—THE STRUGGLES OF A NEW INVENTION.

Some five years ago we gave our readers an account of a new mode of cleansing brewers' casks, invented and patented by Messrs. Davison and Symington, which consisted first, in cleansing the interior of the casks of all adhering matter by means of an ingenious apparatus, which operated through the bung-hole, and rendered unnecessary the old process of unheading; and second, in purifying the casks by passing through them rapid currents of *dry* heated air, instead of steam or moist heat, as used to be, and is now in many parts still the practice. We mentioned at the time that this plan had been adopted with most satisfactory results at the great London brewery of Messrs. Truman, Hanbury, and Co.; and so, in point of fact, it had. Afterwards, however, we learnt that it had been abandoned by that house, and naturally inferred that this arose from its not standing the test of continuous use. The firm of Messrs. Allsop and Co., the celebrated pale-ale brewers of Buxton, was also cited by us as having employed the patent process with great success; but we had the mortification to hear not long after that they too had had occasion

to repent them of patronising the invention—for that a whole season's brewing, which had been sent out to India, had been turned from pale to *red*, all owing to the "new-fangled" mode of purifying the casks. In short, our recommendation became so utterly discredited that we could come to no other conclusion than that we had somehow or other been betrayed into a great mistake. For a long time, we heard no more of the affair, and we finally set it down in our minds as but another instance of the delusion and disappointment in which the history of invention is so particularly rife. On recently paying a visit, however, to Messrs. Hanbury and Co.'s, what was our astonishment to see the process which they were reported to have abandoned (as was the fact), and which we thought had become utterly defunct, in full work! "How was this?" The abandonment had taken place "under a wrong impression;" the firm had discovered their error and "resumed the process," and meant "to use no other in future." We were tempted to mention, in a hesitating way, the names of Allsop and Co. "Oh yes, there had been a story about their having a whole season's brewing spoiled by the process, but it was all nonsense: the ale had been affected in its colour, but not by the cleansing process (how, indeed, should it?) and after a little while it came right enough." "And have Allsop and Co., too, resumed the process?" "Yes, we believe so." Here was a very singular reverse of fortune. An invention adapted to a particular trade is tried by two of the most eminent houses in it, and rejected as useless or unprofitable. Some time after, it is resumed by the very same houses, and gives entire satisfaction. The result is well; but let the reader penetrate in fancy beyond that result, and picture to himself the circumstances which must have attended such a course of events. The sore discouragement which the inventors must have felt under the rejection of their scheme by the best possible authorities! (in most cases, and with most men, it would have produced utter despair of success)—the wonderful spirit of perseverance with which they must have been animated to brave a second time the chances of defeat—to press for another trial where they had already (to all appearance) failed so signally! (Strong, indeed, and intelligent withal, must have been their conviction of the utility of the invention, to inspire such a spirit.) The slights, the taunts, the mortifications, the delays, to which they must have been exposed! The loss of time (for already nearly half of the term of the patent has elapsed), loss of money, loss of personal peace and quiet!

We have ascertained, by subsequent inquiry, that the process is at length beginning to have, as they say, *a run*. Besides Messrs. Truman, Hanbury, and Co., and Messrs. Allsop and Co., it has been adopted by Messrs. Bass and Co., of Burton; Messrs. Guinness and Co., of ral other firms of the same high stamp. Dublin; Messrs. Ind and Co., and seve- Many millions of casks have been already cleansed by this process; and so effectual does it prove, that the number which have required to be unheaded (in order to be subjected to mechanical scouring), has nowhere exceeded 2 per cent. The patent is now become the sole property of one of the patentees, Mr. Davison, to whose business talents and practical experience as a brewery engineer, much of its recent success is no doubt owing.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING DECEMBER 12, 1850.

JOHN TUCKER, of the Royal Dockyard, Woolwich, Kent, shipwright. *For improvements in steam boilers, and in gearing, cleansing, and propelling vessels.* Patent dated June 1, 1850.

The improvements here specified and claimed are:—

1. In the construction of boilers, the placing of the heel or shoe of the funnel on the diaphragm, and causing the funnel to pass through the smoke-box, whereby the steam enters the cylinders in a drier state, and the tendency to prime is lessened.

2. A method of gearing and topping the screw propeller. The screw is attached to the shaft, clear of the dead wood of the vessel, and has a collar connected by an arm and a standard to a second shaft placed above the level of the driving shaft, which bears the weight of the screw when it is topped or raised under the counter of the vessel.

3. An arrangement of apparatus for cleansing the sides and bottom of ships. This apparatus consists of a brush composed of cane or whalebone, arranged on the side

of an air-tight case, which is drawn backwards and forwards, or diagonally, over the sides of the ship by means of ropes suitably disposed and guided.

JOHN SYKES and ADAM OGDEN, both of Dock-street, Huddersfield, York, wool-cleaners and machine-makers. *For certain improvements in machinery for cleaning wool, cotton, and similar fibrous substances from burrs, motes, and other extraneous matter.* Patent dated June 4, 1850.

Claims.—1. The combination, arrangement, and application of a ribbed cylinder, beating drum, and cloth, in the manner and for the purposes mentioned or referred to.

2. The peculiar arrangement, combination, and application of an "arrester" (including its arms, ears, and pins) with the spiral and comb cylinders.

3. The peculiar arrangement, combination, and application of the spiral cylinder, tooth and blade cylinder, and fan cylinder with the arrester, as described and set forth.

DAVID NAPIER, and JAMES MURDOCH NAPIER, of the York-road, Lambeth, Surrey, engineers. *For their invention of improvements in apparatus for separating fluids from other matters.* Patent dated June 4, 1850.

The first of the present improvements, which have all relation to centrifugal machines, consists in placing within the drum an inclined plane running around in the form of a screw, leaving however sufficient space between the exterior of the screw coil and the interior of the drum, to insert either a casing of wire cloth, or a wire-cloth casing, and one of thin perforated metal. Attached to, and supported by a strong rim formed at, and around the exterior of the mouth of the drum, is a toothed ring. The coils of the inclined plane are sustained and kept at their relative distances apart by stays, which are attached at bottom to a plate working loosely round the boss of the main shaft, and are crowned at top with a flat ring which carries two sets of friction rollers, the first of which run in a recess formed in the upper surface of the before-mentioned toothed ring, which the others bear against its interior periphery. This ring also carries bearings for a worm-wheel gearing into the toothed ring. On the worm-wheel shaft is keyed a toothed wheel actuated by a flange on the casing of the drum, each revolution thereof causing the flange to take into a fresh tooth of wheel, and thereby giving to the inclined plane or screw coil an independent rotative motion, which raises the "matter" deposited on the coils of the plane, and forces it over the mouth of the drum, either into the casing at any part of its periphery, or at one particular point, by arranging there a tangent shoot in connection with fans or blades fixed on the mouth of the drum. The latter arrangement is more particularly applicable to the treatment of saccharine matter, in which case, as it is desirable that the sugar should be discharged as dry as possible, the pipe for introducing syrup or water, and which should be in connection with the vat for containing the syrup or water, may extend downwards into the drum to such a depth as will permit the injected liquor to be discharged before the sugar by the action of the inclined plane reaches the top of the drum. A pipe for introducing steam when requisite is also provided in addition to the feed pipe for supplying matter to be operated on.

A second improvement consists in suspending the machine in such manner, that its vibrations shall not be communicated to the building in which it is placed. This is effected by connecting the drum to the cross-head in which its shaft revolves by means of iron-rods, an eye-bolt being attached to the cross-head for suspending the whole apparatus.

A third improvement consists in providing the drum with a false bottom, having a long boss capable of sliding up and down on the shaft. To this boss is attached a pulley or other suitable contrivance for raising the false bottom, and thus discharging the drum.

Messrs. Napier specify lastly an improved brake, which consists of a metal ring placed underneath the drum, which is stopped or retarded by bringing the ring in contact with it by the depression of a lever.

Claims.—1. The constructing of centrifugal apparatus for extracting fluid from other matters, in such manner that a supply of the matter to be operated on, and discharge of the matter operated on, may be effected during the rotation, and by the working of the apparatus.

2. The suspending of centrifugal apparatus as explained.

3. The arrangement of apparatus for discharging the drum or rotating vessel of its contents after operating by centrifugal action.

4. The stopping or retarding the motion of centrifugal apparatus used for separating fluid from other matters by applying a mechanical brake to act on the drum or rotating vessel.

THEODORE CARTALI, of Manchester, merchant. *For certain improvements in the treatment or preparation of yarns or threads for weaving.* (A communication.) Patent dated June 4, 1850.

Mr. Cartali's improvements consist in giving the yarns an extra twist, so that cloth made from them shall on the applica-

tion of moisture become permantly creased or pleated. The extra twist may be imparted by any of the means ordinarily in use, and steam or moisture may be applied during the operation or not,—in the former case the twist will be imperceptible in the yarn, in the latter it will be visible, but the effect of each, when woven and damped is stated to be precisely similar. When the yarn is bleached it may be twisted before being woven, but grey yarns are best woven first, and the cloth bleached afterwards.

Claim.—Subjecting yarns to an additional operation of twisting after they have been manufactured by the mule, throstle or other spinning machine.

WILLIAM WATSON, the younger, of Chapel Allerton, York, manufacturing chemist. *For improvements in the preparation and manufacture of various substances to be used in the processes of dyeing, printing, and colouring.* Patent dated June 4, 1850.

The present improvements consist in the economical production in a dry state of certain compounds of indigo (dissolved in its imported or refined state), in concentrated sulphuric acid, and alkalies, or alkaline earths, such as soda, potash, barytes, strontia, lime and magnesia, or alkaline salts, of which, however, owing to the expense or inconvenience of using some of them, the patentee prefers to employ chloride of sodium (common salt), the carchloride or subcarbonates of soda, potash, and magnesia, and sulphate of potash; he observes that any of the alkaline salts capable of being dissolved by sulphuric acid, may, nevertheless, if desired, be similarly employed.

Claims.—1. The addition or mixing of a solution of indigo in sulphuric acid, to or with common salt in the manner explained.

2. The addition or mixing of a solution of indigo in sulphuric acid, to or with sulphate of potash.

3. The addition or mixing of a solution of indigo in sulphuric acid, to or with caustic potash, caustic soda or caustic magnesia.

4. The addition or mixing of a solution of indigo in sulphuric acid, to or with carbonate of potash, carbonate of soda or carbonate of magnesia.

5. The manufacture of compounds, or preparations of indigo, by the admixture of any suitable alkali, or alkaline earth, or the salt of any alkali, or alkaline earth, with a solution of indigo in sulphuric acid, so as to form dry or solid compounds of the nature set forth.

PAUL D'ANGELY, of Paris, France, gentleman. *For certain improvements in the construction of privies and urinals, and in apparatus and machinery for cleansing privies, cesspools, and other places, and in deodorizing the matter extracted therefrom, and rendering it available for agricultural purposes.* Patent dated June 4, 1850.

Passing over the arrangements described by M. D'Angely in the construction and mode of cleansing the places referred to in the title, as being almost entirely destitute of novelty, we come to his deodorizing fluid, which is manufactured thus:—He first places 200 lbs. of bark in a vessel containing 165 gallons of soft water, and boils it until completely macerated. Into a second vessel, containing 85 gallons of water, he puts 40 lbs. of green or 80 lbs. of dried rue, or wild mint, and this also is well boiled. After clearing the two infusions, they are mixed together and boiled; 200 lbs. of sulphate of iron and 160 lbs. of pyrolignite of iron are then added, and the boiling continued till they are dissolved. Sufficient water is to be added to make the whole quantity 250 gallons. It is stated, however, to be indispensable that the sp. gr. of the mixture should not exceed 16° Baumé, or 1·125, nor be lower than 15° Baumé, or 1·116.

Fæcal matter having been deodorized by means of this compound, added in the proportion of about $7\frac{1}{2}$ per cent., is dried in a close chamber maintained at a heat of from 70° to 90° Fahr. Half the floor of the chamber is composed of bricks enamelled, and the other half of tiles prismatically shaped, and arranged at distances of about half an inch apart. When the operation is about half over, the matter is to be shovelled on this portion of the chamber, through which it falls when dry into a receptacle placed beneath.

Manure is composed of dried or burnt peat, or of dried beasts' blood, both in powder and mixed with the dried fæcal matter, in the proportion of one-third of the latter to two-thirds of either of the former.

No claims.

EDMUND SHARPE, of Lancaster, M.A. *For certain improvements in railway carriages.* Patent dated June 5, 1850.

Claims. — 1. A method described of constructing the framework of low carriages as far as regards the outside beams, or sole guard-pieces and under rails of carriage bodies, and the mode in which the same are connected and bound together to give additional strength to the framework.

2. A buffing apparatus as described, in so far as regards the peculiar shape of the buffer head, and the combination of two buffer rods.

JOHN MC NICOLL, of Liverpool, engineer. *For improvements in machinery for*

raising and conveying weights. Patent dated June 6, 1850.

Claim.—A method of combining and arranging the machinery of a travelling crane, in which a portable or stationary engine is caused, by means of a shaft running longitudinally off the rail or tramway, to give motion to the working parts of a travelling crane, so as to cause it to lift and convey weights.

William Edward Newton, of Chancery-lane, civil engineer. *For improvements applicable to boots, shoes, and other coverings for, or appliances to, the feet.* (A communication.) Patent dated June 6, 1850.

Claims.—1. The preparation of the sole or under surface of India rubber shoes, buskins, gaiters, boots, and over-shoes, by inserting therein or attaching thereto metallic "points," permanently secured in or to such sole or under surface in either of two methods mentioned or referred to (*i. e.*, by inserting the points separately, or by casting them on to plates which are placed so as to allow the points to project through the sole, or by attaching the points to a separate piece of India rubber which is then cemented to the outside of the sole), and the application of metallic points permanently secured to such sole or under surface, to the manufacture of India-rubber shoes, buskins, gaiters, boots, and over-shoes, to prevent their wearing, and make them less liable to slip or slide when worn upon ice, snow, or other smooth or slippery surface.

2. The employment of a partial or entire sole in combination with an elastic strap, for the purpose of preventing the wearer from slipping on smooth surfaces.

3. Making the sole of clogs of India-rubber sponge, prepared substantially as described (*i. e.*, by mixing sugar or resin with India-rubber previous to its undergoing the vulcanizing or curing process), but without restriction to the use of sugar or resin, as other substances which will evolve gas in large quantities during the curing process are equally applicable, although sugar and resin have been found to be the best. Also, making the sole of clogs made of India-rubber sponge, or any preparation of India-rubber, with a rim and protuberances so as to elevate the foot from the ground without making the article of too great weight.

4. Making boots, shoes, and other coverings for the feet or parts thereof, pervious to the perspiration of the wearer by making such articles of sheet rubber perforated with minute holes, or of the before mentioned India-rubber sponge rolled into thin sheets.

William Newton, of Chancery-lane, civil engineer. *For certain improvements in the manufacture of cords, ropes, bands, strong cloths, quilting, sacks, and cushions,* and in elastic material for stuffing the latter, *in which manufacture caoutchouc forms an essential ingredient; and in the application of parts of these improvements to the manufacture of pads, stoppers, tubes, boxes, baskets, coverings, wrappers, and other like articles of utility.* (A communication.) Patent dated June 8, 1850.

The words of the title printed in Roman letters have been disclaimed by Mr. Newton, he having discovered from the description of the invention communicated to him by his foreign correspondent that this part of it is neither "new nor likely to be of general benefit or advantage."

Claims.—1. (With relation to India rubber cord fabrics.)—The making of the various articles enumerated (*e.g.*, hose, hat-boxes, gun-cases, tumblers, kitchen and other vessels, covers for bottles, mats, tow ropes, cords, coal-scuttles, and those articles which are formed in or on moulds), as well as any other like or similar articles by winding or connecting together cords of "India rubber vellum" in the green or tacky state, and then submitting the same to the process of curing, to secure the union of the various parts in manner substantially as set forth.

2. The manufacture of cellular fabrics by uniting together sheets of India rubber, vellum, tissue, vegetable leather, or other similar or equivalent India rubber fabric at stated intervals, so as to form cells as set forth. When employed in the manufacture of life-buoys or preservers, it is preferred that the cells should be distinct and inflated, or stuffed with buoyant matter individually; in other cases the cells are in connection with each other.

Under the third head of the specification, which relates to the manufacture of "strong cloth" for ships' sails and other uses, by combining bats or fleeces of cotton with India rubber in the green or tacky state; no claim is made.

James Colman, of Stoke Mills, Stoke, near Norwich, mustard and starch manufacturer. *For improvements in the manufacture of starch.* Patent dated June 8, 1850.

Mr. Colman's improvements consist in the employment of borax or cream of tartar (sometimes called the supertartrate, but more properly the bitartrate of potash), either alone or in combination with newly-burnt unslacked lime, to separate the gluten from the starch in rice and other leguminous or farinaceous substances from which starch is manufactured.

Forty gallons of a solution composed of 20 lbs. of borax dissolved in about twenty times its weight of warm or heated water and one bushel of lime, with sufficient water to make the whole quantity about 50 gallons, are added to a ton of rice, previously steeped in an alkaline ley made with soda instead of potash, as being less expensive, and having less tendency to render the starch deliquescent, and levigated in the usual manner. The mixture is placed in a churn and well agitated for two or three hours, so as to bring every part of the rice under the action of the solution. After the whole has been allowed to settle, and the supernatant liquid drawn off by syphons or otherwise, the starch is ready for the operations of boxing, &c., ordinarily practised.

Claim.—The application of a solution of borax or bitartrate of potash and lime, or of borax or bitartrate of potash alone, to act on the pulpy matters from which starch is to be separated, and to facilitate or promote the separation of starch from the matters with which it is mixed.

William Robertson, of Gateside Hill, Neilstone, Renfrew, Scotland, machine-maker. *For improvements in certain machinery used for spinning and doubling cotton and other fibrous substances.* Patent dated June 6, 1850.

Claims.—1. The use and application of an epicyclic train or system of wheels, as described and shown, or of any other train or system of wheels on the same prinsiple (as, for instance, with bevel wheels instead of spur pinions, as shown), for the purpose (in combination with or through the intervention of suitably-arranged mechanism or mechanical parts) of taking the carriage in and winding the yarns on to the spindles; the train in this case receiving motion from one single driver only (by means of a belt, but without restriction thereto)—the peculiar property of such train so driven to communicate a varying motion, being thereby at liberty to act in the manner described.

2. The use and application of such an epicyclic train, and the peculiar adaptation and arrangement of parts in connection therewith, as described, for the purpose of taking the carriage out and of giving motion to the drawing rollers conjointly—the train in this case receiving motion from two drivers (by means of two belts, but without restriction thereto), and in which case the train so driven gives off for each operation a determined amount of uniform motion, not now possessing the property of imparting a varying motion, which it possessed when driven by one belt only.

Mr. Robertson here observes, that he has shown and described his invention as applied to that class of "mules" termed self-acting, but that it is also applicable to hand mules, the modifications requisite for its adaptation to this class of machines being such only as would readily suggest themselves to any workman conversant with them.

3. The use of a friction disc and brush-wheel and connecting gear to the tempering screw, as a regulating apparatus for winding on the yarn.

4. The movement of the pulley, chain, and rope, and apparatus in connection therewith, by which the reversing movement, whether derived from the epicyclic train or from any other similar mechanical arrangement, works the fallers before it begins to draw in the carriage.

5. The construction of the builder-frame and dropping lever in the copping motion, as described—the same being both jointed on one centre.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, London. *For certain improvements in oscillating engines put in motion by steam and gas resulting from combustion.* (A communication.) Patent dated June 8, 1850.

Claims.—1. The use, as a motive power, of steam and gases raised to a very high temperature, and in a state of dilatation, in the manner described.

2. The constructing oscillating engines composed of an annular capacity divided into compartments.

3. A peculiar mode of disposing the slide valve in oscillating engines, so as to regulate the admission of the motive power.

4. Regulating in oscillating engines, by the suction of the engine itself, the admission of atmospheric air, so as to produce the best and most possible effects.

Charles Warwick, of Cheapside, warehouseman. *For improvements in apparatus for taking up the work of certain descriptions of knitting machinery.* (A communication.) Patent dated June 8, 1850.

Claim.—A mode of combining and arranging machinery for taking up or moving away work as it is produced in circular knitting machines.

The work produced passes over guides, and is fastened at its ends to a spindle supported in a revolving frame under the machine. The spindle carries a ratchet-wheel, and is caused to revolve and take up the work by means of a clawker held to it by a spring, and connected by a rod to the short end of a lever whose fulcrum is in the revolving frame. The long end of the lever carries a friction roller, which, coming in contact with "rises" on the lower plate of the frame, during its revolution by the drag of

the work, is alternately raised and depressed, and thus causes the clawker to act on the ratchet wheel of the spindle.

JAMES ALEXANDER HAMILTON BELL, of New York, America, merchant. *For improvements in dressing bran, pollard, and sharps.* Patent dated June 6, 1850.

Mr. Bell makes use, in some cases, of a compound punched and reticulated cylinder, and in others of a cylinder covered with strips of punched iron, and strips of leather filled with tacks; but he admits that both of these are old contrivances. He employs also an arrangement of gearing for working his machine, which is equally old; but what he claims as new is the combination and arrangement of an external, upright, stationary close cylindrical case, with an internal compound punched and reticulated upright stationary scourer and bolt, and a revolving cylindrical scourer and blower, "constructed, arranged, and operated in the manner described," by means of which the fine flour that usually adheres to the bran, after the first bolting operation, is completely separated from the bran, and collected in the annular space between the cylindrical bolt and the cylindrical case, from whence it descends through segmental openings in the horizontal base, upon which the bolt and case rest, into conducting spouts, whilst the bran is blown from the interior of the bolt through a spout leading through the external case; the meshes of the bolting cloth being kept open by the pressure of the air produced inside the combined cylindrical scourer and bolt by the manner in which oblique, radial, and parallel wings or vanes are arranged in the revolving scouring and blowing cylinder.

GEORGE JACKSON, of Belfast, Ireland, flax spinner. *For improvements in heckling machinery.* Patent dated June 6, 1850.

Claims.—1. A method of reversing the motion of cylinder or other surfaces of heckles.

2. An arrangement of heckling machinery, wherein one heckling surface is employed to heckle (during each traverse of the holders across the machine) in such manner that two sets of holders may be worked in combination with one heckling surface.

3. The application of a lever in connection with other apparatus for moving the holders in heckling machines.

4. A method of applying stripping apparatus to the heckles of heckling machines.

WILLIAM COX, of the firm of William Cox and Co., of Manchester, cigar merchant. *For certain improvements in machinery or apparatus for manufacturing aërated waters or other such liquids.* (A communication.) Patent dated June 11, 1850.

Mr. Cox proposes to dispense with mechanical aid in the operation of impregnating liquids with carbonic acid gas, by causing the gas to be retained in the generator till it attains a pressure of from 300 lbs. to 400 lbs., on the square inch, and then passing it through the purifier to the cylinder containing the liquid to be aërated. The gas produced by one gallon of sulphuric, or hydrochloric acid, acting on double that quantity of lime or chalk set in agitation in a close vessel containing about four gallons of water, is stated to be sufficient to impregnate, in about fifteen or twenty minutes, eighteen gallons of liquid, or even more.

Claims.—1. The construction and arrangement of apparatus, as shown and described, whereby the impregnating gas may be sustained at a pressure sufficient to cause its amalgamation with the water or other liquid to be aërated, without the aid of a force-pump or other mechanical means of pressure; without restriction, however, to any dimensions of vessels employed, or to any suitable modification of their arrangement, or to the materials of which they are composed.

2. A peculiar form or construction of tap represented as adapted to such or similar purposes.

PAUL RAPSEY HODGE, civil and mechanical engineer, of Adam-street, Adelphi. *For improvements in certain descriptions of steam engines, and in the apparatus and management for cultivating and manuring the soil, and in treating the produce thereof.* (Partly a communication.) Patent dated July 3, 1850.

Claims.—1. A method of cutting off the steam in its passage from the boiler to the cylinder at any portion of the stroke by the steam valve, without the use of a secondary expansion valve, by means of an engaging and disengaging apparatus placed between the steam valve and the lifting rod.

2. The peculiar construction described of returned flue boiler for locomotive and portable engines, having the chimney passed through the steam drum; and also a peculiar construction of apparatus for surcharging the steam in the smoke box, and for maintaining the heat in the cylinders at the same temperature as the surcharged steam.

3. A method of surcharging the steam in use by and when working steam engines, and for the purpose of maintaining a high temperature in and around the cylinders.

4. A mode of constructing oscillating cylinders with annular steam chests working in close connection and communication, so as to dispense with separate and detached steam valves for charging and exhausting the cylinders.

5. A new construction of packing for the glands and stuffing boxes of steam engines.

6. Constructing the outer side of flat surfaces of boilers with undulated forms or ribs.

7. An improved steam-digging machine for cultivating the soil and mixing the manure spread over its surface.

8. Several improved machines for treating the produce of the soil (including a hulling machine, a smut machine, and an apparatus for separating pieces of straw from grain as it comes from the threshing machine, and previous to its introduction into the winnowing machine;) and also a new composition to be employed as a substitute for burr and other stone in the manufacture of millstones.

9. The construction of a high and low-pressure cylinder working in "consort" (*query*, concert) on Woolf's principle, but with the exception that the cranks are placed at an angle of 180°, the cylinders being worked direct on to the cranks without the intervention of a beam.

William Pole, of Great George-street, Westminster, and David Thomson, of Belgrave-road, Pimlico, engineers. *For improvements in steam engines.* Patent dated June 11, 1850.

These improvements apply to the double-cylinder expanding engine.

The patentees state that they do not consider it advisable to allow the steam to enter the small cylinder during the whole stroke, but that there is a certain part of the stroke (depending on the degree of expansion to be made use of) at which it is peculiarly advantageous to cut off the steam, by reason that the irregularity in the moving force is then reduced to a minimum. They also consider it desirable that the valves of the engine (which should be of the simplest possible character, and so arranged as to cause the least possible loss in the passages) should be made to cut off the steam at the above-named, or any other desired point of the stroke, without the addition of a separate expansion valve.

The improvements intended to effect these objects consist of, "an improved arrangement of valves and apparatus for moving the same, applicable to double cylinder steam engines, according to which arrangement a single sliding valve is made to answer the purpose of opening the requisite passages to and from both cylinders in the most advantageous manner, and also to cut off the steam from the small cylinder at any required point of the stroke, within reasonable limits, without the addition of a separate expansion valve." Various modes of accomplishing these objects are shown in the drawings attached to the specification.

Frederick Albert Gatty, of Accrington, Lancaster, manufacturing chemist. *For a certain process or certain processes of obtaining carbonate of soda and carbonate of potash.* Patent dated June 11, 1850.

Mr. Gatty, in carrying out his invention, places 300 gallons of the neutral tartrate of soda or of potash (of the strength of 8° Twaddel's hydrometer) in a vessel capable of holding 400 gallons. To this he adds 34 gallons of lime milk, each gallon containing 1 lb. of lime, and sets the whole in agitation, forcing in at the same time a stream of carbonic acid gas (obtained by any of the ordinary methods), until the whole is well saturated. The bicarbonate of soda or potash thus formed is separated from the tartrate of lime, washed, and evaporated to dryness. It is then calcined, and becomes converted into a sub-carbonate sufficiently pure for most manufacturing purposes. The tartrate of lime, when well washed, will be in a fit state to be employed in the manufacture of tartaric acid, and the liquor obtained by the first washing is to be evaporated and treated as above described, in order to obtain the bi-carbonate of soda or potash contained in it. Instead of lime, carbonate of lime, or a mixture of carbonate of lime and lime may be employed; but Mr. Gatty considers lime alone to be preferable.

Claim.—Obtaining carbonate of potash or carbonate of soda by decomposing a solution of the neutral tartrate of potash, or of the neutral tartrate of soda, with carbonic acid gas and lime, or with carbonic acid gas and carbonate of lime, or with carbonic acid gas and a mixture of lime and carbonate of lime, as above described.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Henry Walker Wood, of Briton Ferry, near Neath, Glamorganshire, gentleman, for improvements in the manufacture of fuel. December 7; six months.

Samuel Rayner, of Berner's-street, Oxford-street, Middlesex, artist, for improvements in paving. December 7; six months.

Archibald Turner, of Leicester, manufacturer, for improvements in applying heat for generating steam for motive power and for other purposes, and in generating heat, and in heating and evaporating fluids. December 7; six months.

James Thomson Wilson, of Stratford-le-Bow, Middlesex, chemist, for improvements in the manufacture of alum, and in obtaining ammonia. December 7; six months.

Francis Papps, of Camberwell, chemist, for improvements in metallic and other bedsteads, mattresses, and curtain rods, and in the coating or covering of bedsteads, and other articles wholly or in part composed of metal. December 7; six months.

Alexander Mein, of Glasgow, accountant, for certain improvements in treating the fleeces of sheep when on the animals. (Being a communication.) December 7; six months.

John Mortimer, of Hanover-square, Middlesex, esquire, for improvements in the magnetic needle and mariners' compasses. December 7; six months.

George Henry Voyez, of Acton-strret, Middlesex, artist, for improvements in the manufacture of paper hangings. December 7; six months.

James Ward Hoby, of Glasgow, engineer, for improvements in the construction of the permanent way of railways. December 7; six months.

John Everest, of Tonbridge, Kent, and George Osborne, of the same place, for certain improvements in commodes, and in fixed and portable water-closets. December 7; six months.

David Lloyd Williams, of Thornhill, Llancillo, Carmarthen, gentleman, for certain improvements in furnaces. December 7; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in engines to be worked by steam or other power. December 7; six months.

Richard Archibald Brooman, Fleet-street, London, patent agent, for improvements in agricultural machines. (Being a communication.) December 7; six months.

Peter Wood, of the firm of Thomas Bury and Co., dyers, calenderers, and finishers, Adelphi Works, Salford, Lancaster, for improvements in figuring and ornamenting woven fabrics, and in machinery employed therein. December 11; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in cutting and dressing stone. (Being a communication.) December 12; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in the manufacture of iron hurdles or fences, and of certain other articles in the construction of which wire-work is or may be employed. (Being a communication.) December 12; six months.

William Beckett Johnson, of Manchester, Lancaster, manager, for certain improvements in steam engines and in apparatus for generating steam; such improvements in engines being wholly or in part applicable where other vapours or gases are used as the motive power. December 12; six months.

John Mason, of Rochdale, Lancaster, machine-maker, and George Collier, of Halifax, York, manager, for certain improvements in preparing cotton and other textile materials for spinning, and in tools or apparatus for making cards and other parts of such preparing machinery, and in engines for giving motion to the same, which engines are also applicable in other cases where motive power is required. December 12; six months.

Samuel Baxter, of Wapping, Middlesex, shipwright, for improvements in apparatus for lifting, and for facilitating the working or steering of ships. December 12; six months.

Thomas Hoskins Howels, of Amelia-row, Landport, Portsea, Hants, gunner, for improvements in gun-carriages. December 12; six months.

Joseph Bennett, of Deptford, Kent, engineer, for certain improvements in doors, window-shutters, and blinds. December 12; six months.

Edmund Morewood, of Enfield, Middlesex, gentleman, and George Rogers, of the same place, gentleman, for improvements in coating or covering metals. December 12; six months.

Jean Aime Marncls, of Lyons, for improvements in the manufacture of indigo. (Being a communication.) December 12; six months.

Joseph Baldwin and George Collier, both of Halifax, mechanics, for improvements in the manufacture of carpets and other fabrics. December 12; six months.

George Royce, of Fletland, Lincoln, miller, for improvements in grinding, dressing, and cleaning corn and seed. December 12; six months.

George Benjamin Thorneycroft, of Wolverhampton, Stafford, iron-master, for improvements in the manufacture of crank-axles. December 12; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Nov. 5	2572	J. W. M. Last	Strand	Improved printing machine.
6	2573	Charles Warner	Birmingham	Penholder.
,,	2574	William Langford	Hitchin	Gas stove.
,,	2575	Richard Batt and Sons.	Edward-street, Portman-square	Versicolor trousers.
9	2576	William Marshall	Regent-street	Shirt.
,,	2577	George Barnett	Jewin-street	Magical cylinder strop.
,,	2578	Ransones and May	Ipswich	Parts of a water crane for railways.
10	2579	E. R. Turner and Co.	Ipswich	Roller mill.

CONTENTS OF THIS NUMBER.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1428.] SATURDAY, DECEMBER 21, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MR. MAUDSLAY'S SELF-ACTING SCREW-PROPELLER.

Fig. 3.

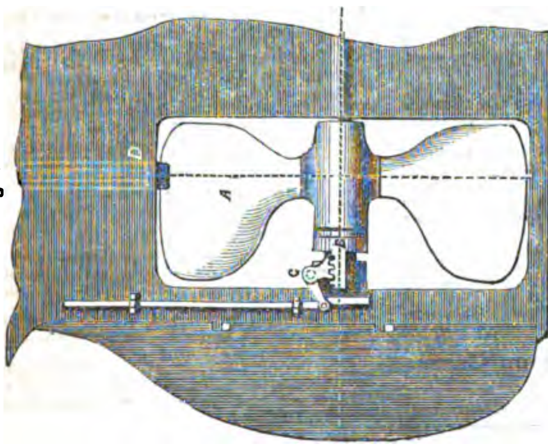


Fig. 4.

Fig. 1.

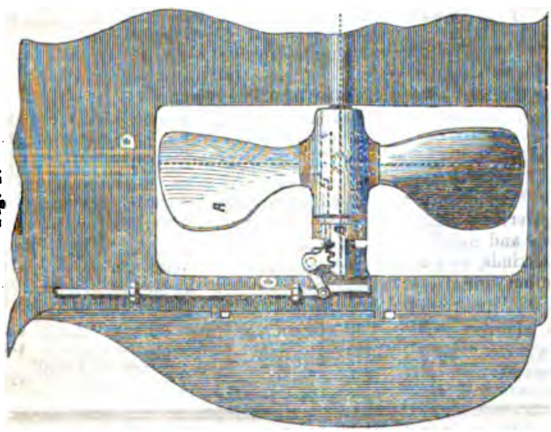


Fig. 2.

MR. MAUDSLAY'S SELF-ACTING SCREW-PROPELLER.

In vol. xlix. of our Magazine, page 241, we gave a drawing and abstract of specification of a self-acting stern propeller, patented by Mr. Joseph Maudslay. We are now enabled to present our readers with particulars of the invention, as it has been applied to the *Bosphorus* screw-steamer, employed in the mail service between England and the Cape of Good Hope. As a propeller, this variety is found fully as effectual as those of the ordinary construction, and affords at the same time the important advantage of assuming of itself such a position that its blades present a thin edge only, to be drawn through the water when the force and direction of the wind are such as to render it unnecessary to employ steam power; the blades are then placed in a perfectly upright position in the wake of the stern-post, and thus offer no impediment to the perfect efficiency of the vessel as a sailing ship, without the necessity of having recourse to the troublesome and difficult operation of unshipping the screw. The facility thus offered of converting a steamer instantaneously into a perfect sailing ship, and *vice versâ*, is of the utmost importance in long voyages, where it is of great moment to economize fuel by using steam power only when the wind is unfavourable.

Fig. 1 of the prefixed engravings is an elevation, and fig. 2 a plan of the propeller when in steaming position; and figs. 3 and 4 elevation and plan in feathered position for sailing. A A are the blades of the propeller, which terminate in round trunnions or pivots, connected in the body of the boss by flying pinions gearing into segments of bevelled wheels cast on the ends of the blades. B is a clutch for locking the blades when it is wished to go astern. C is a rod and bell-cranked lever for working the clutch; and D is a key or wrench for holding the blades in a fore-and-aft position, or turning them on their pivots when required.

THE VOYAGE OF THE "BOSPHORUS."

Three hundred and sixty-four years have elapsed since Bartholomew Diaz sailed from Lisbon in two caravels of fifty tons each, and, rounding the southern promontory of Africa, called it, from the storms he experienced in its vicinity, "*Cabo Tormentoso*." His discovery tranferred for a time the commerce of the east from the Venetians and Genoese to the Portuguese; and for upwards of three centuries the route by the Cape was the high road to India and the regions beyond it.

To-day (Dec. 14) a voyage commences as pregnant with changes as that of Bartholomew Diaz in his caravels of fifty tons. To-day the screw steam-ship, *Bosphorus*, sails with the mail to the Cape of Good Hope. The day marks an era in steam navigation, a step forward in the civilization of the globe.

Twenty years ago the operations of steam vessels were confined to coasting voyages. The giant power was still in swaddling-clothes. Its first display of adult vigour was made when the *Hugh Lindesay*, under the auspices of the East India Company, proved the practicability of re-establishing the ancient route to the East by the Red Sea. Its second was when Captain Roberts and Captain Hosken, in the *Sirius* and *Great Western*, first "bridged the Atlantic" by steam.

The spread of steam navigation over the globe has been checked by the interference of Government, who, influenced by the old notion that improvements require monopolies to encourage them, granted to favoured contractors virtual monopolies of ocean steam navigation. Private enterprise was paralyzed by the mail contract system, and for years no ocean steamers were built except by Companies holding the Government mail contracts. These monopolies kept down the inventive genius of our countrymen; for everyone was afraid to venture on new experiments, lest the favourites of Downing-street should step in and reap the reward of his enterprise and skill. At last the Americans have girded themselves to the contest, and at their first trial they have equalled Cunard's line, indisputably the best we have.

It is to the system of screw propulsion, first practically introduced by Ericson, in 1837, that we look for the maintenance of our ascendancy in ocean steam navigation. This system was stifled for ten years by the great contract companies. For the last three years, however, it has been rapidly extending; it has, without Government assistance, carried goods and passengers to New York, Alexandria, and Constantinople with such speed, punctuality, and economy,

that the great monopolists are now themselves laying down screw steamers, with the vain hope of crushing their unsubsidized competitors.

The definition of a paddle-wheel steamer is a vessel that makes most way without wind or sails; that of a screw steamer, one that sails best with wind and steam combined. The first defies the elements at an enormous cost; the other presses them into her service, and makes a fair wind of 24 out of the 32 points on the compass. This is the reason of unsubsidised screw steamers having been made to pay against the competition of Cunard's line with 145,000*l*. per annum of the public money, and against that of the Peninsular and Oriental with its 220,000*l*. If the *Bosphorus* makes a fair voyage, the doom of paddle-wheel steamers, and of our ocean mail contracts (at least in their present form), is sealed.

The steam-packet service by way of the Red Sea, even burdened as it has been by the virtual monopoly of one favoured Company, has increased the personal intercourse of this country with the eastern world to an extent never dreamt of by its first projectors. The spread of railways, and the wondrous invention of the electric telegraph, must, while peace lasts on the Continent, always make what is called the overland route of great commercial and political importance. Cost what it may, it must be kept up as long as we retain our Eastern empire. But even were it relieved from the incubus of monopoly, it is only for the more wealthy class of passengers, and for those to whom the passage of the Desert is no painful exertion, that it can be available. The extension of steam communication beyond the Cape to India will be an inestimable boon to the great majority.

The effects of this new era of steam navigation on our colonial possessions will be still more marked. According to Mr. Laming's evidence before the Committee of the Lords on the Slave Trade, it is cheaper to sail a screw steamer than a common sailing ship of the same capacity, on a given voyage. Now, as it is ascertained that the *average* speed of the common paddle-wheel steamer can be kept up by the screw auxiliary in short voyages, it requires no great amount of nautical experience to prophesy that where the trade winds prevail, a steamer whose best point is a stiff breeze, will make a better voyage than one whose element is calm. The voyage of the *Bosphorus* is the first trial of the trade winds. The Cape is half-way to Australia; and there are half a million of people there calling out for steam communication. Will the Chancellor of the Exchequer inquire whether he cannot carry the Australian mail by the way of the Cape for the mere postage of the letters? We fear there are too many M.P.'s interested in the matter to allow of his doing so. But the Legislative Council of New South Wales has resolved to award the sum it voted towards the establishment of steam communication to any person or company who shall first establish it by private enterprise.—*Daily News, Dec.* 14.

FOOT-CROSSINGS.

In No. 1399 of the *Mechanics' Magazine*, a letter was published which had been submitted in the year 1844 to the Commissioners for the Improvement of the Metropolis, suggesting various works for the embankment of the Thames, the whole being a compilation from papers left by Sir Samuel Bentham. Amongst "minor details" was specified, "Foot-passages under the carriage-road for crossing under it, so as to afford, without danger, access to the streets connecting the terrace with the town;" and some time before then a proposal had been made privately to one of those Commissioners to form tunnels for foot-passengers under the carriage-ways of some of the most frequented streets of the metropolis. This great desideratum is now under consideration by the City authorities, in so far as the excavating a tunnel passage at the end of London-bridge; but without reference to the previous proposal of 1844, or to the *Mechanics' Magazine* of June 1, last.

There are, however, several objections (generally speaking) to tunnels under streets, such as difficulty of cleansing them of the mud brought in from dirty streets; the retreat they would afford to immoral persons, since no artificial illumination is found to check vice as does the light of day; and the interference of a tunnel with the many subterraneous apparatuses under our thoroughfares—gas and water pipes for example—and sewers, which in most streets would prove an almost insurmountable obstacle to the formation of tunnels. These objections led to the idea and contrivance of *bridges* across streets, the structure elevated so as not to impede the passage of carriages under it; and such a work being more strictly architectural than mechanical, taking into account its necessary connection with dwelling houses. A paper on the subject was sent some months ago for insertion

in the *Builder*. No notice was taken of the communication till last Saturday, the 7th inst. On that day, under the head of "Crossing City Thoroughfares," it was said, "A correspondent suggests that a lighted sub-way with shops (which would soon pay expenses) should be formed under the street * * * A previous correspondent suggested the formation of light foot-bridges above the streets for such thoroughfares." The *Builder* goes on to expatiate on the extreme danger to which pedestrians are exposed in crossing much-frequented streets, and that "perhaps no improvement whatever will be more essential than this," recommending the execution of such works "before the hubbub of next year."

That "*previous* correspondent" was the writer of the present communication, signing with the usual initials, and accompanying the paper with place of residence as usual; and it was that "previous correspondent" who proposed to compensate for such a work by the rent of shops to be connected with it.

Like most measures of general utility that are not fortunate enough to be pushed on by private interests, safe street crossings are likely to be neglected; but the Editor of the *Mechanics' Magazine* might lend a powerful helping hand towards their accomplishment. In the hope that he will be favourably inclined, the following plan suggested to the *Builder* for street-crossing bridges is repeated—it may, at least, tend to the contrivance of some superior structure.

The general idea was to throw bridges, of light construction and appearance, at very distant intervals over streets of great carriage traffic, consequently of imminent danger to pedestrians in crossing the carriage-way. The structure proposed to the *Builder* was to be principally of iron—columns, and other parts exposed to pressure, of cast iron; and those exposed to tension, of wrought iron. Columns for the support of a platform might be at the kerbstone of the foot-pavement; where streets are broad, other columns might also, without inconvenience, be erected in the middle line of the carriage-way, and thus the seams above be shorter than would otherwise be required. The platform of the bridge, besides the breadth for passengers, to have an addition of six or eight feet; on this a row of shops to be erected, for the double purpose of sheltering the footway from wind, and of compensating by their rent for the money expended on the structure. The whole bridge strengthened by means of the hand-rail on the footpath-side, and other rails along the front upper part of the shops, and at the back of them; all of these rails connected together overhead by transverse bars or rods, in the manner of Sir Samuel's "platform bridges," and of the rail proposed for the Thames embankment in the above-mentioned communication to the Commissioners for the Improvement of the Metropolis. The shops to be warmed from one general source of heat, the whole lighted at night by gas, and, of course, always under the inspection of the police.

The greatest difficulty to overcome, whether in regard to a tunnel or a bridge, is the means of access to it. No chasm for stairs to a tunnel could be admitted of in either footpath or carriage-way; nor could space be afforded in either for the erection of a staircase. Stairs, too, are objectionable, on account of dirt—not much so to a man, but extremely annoying to the petticoated portion of the community, for whom safe crossings are most needed. On this account it was proposed that access to the bridge should be by inclined planes; spaces for them might at the west-end of the town be frequently found in the back yards of houses, or where there happens to be an arcade, as the Burlington or Lowther, the incline might descend into it. Passages from the incline to the bridge would necessarily be through some adjacent house—a startling circumstance at first sight; but it must be considered that in streets of great resort it is the shop which gives value to the house, the upper floors being mostly used as mere store rooms, when not let as lodgings at low rent. By the proposed passage through an upper floor, it would acquire a value equal to that of the shop below, especially for the sale of goods particularly suited to the wants of women and children. Were inclines adopted, transverse ribs should cross them to prevent slipping of the foot—the ribs turned up at the ends, so that dirt might be swept down under them, but connected with the hand-rail at one side, the shop at the other, thereby affording additional strength to the structure. In some few

places in the City, as Bridge-street, Blackfriars, and Farringdon-street, the width of street might be great enough to admit of an inclined plane, and where graveyards are already thoroughfares, it could not be considered as a desecration of them when burials in town have ceased, if (where no other site can be found) they should be made accessory to street-bridges, and thus contribute to the safety of the living. Mention is made of these sites from an impression that they might be found eligible, but for a general decision as to the most desirable situations for street crossings, much previous examination of the several most dangerous localities would be desirable; and it may be added that conciliatory communication should be held with inhabitants whose houses might be implicated in any plan for such improvements, so that neither private interests nor private inclinations might be sacrificed.

Another way in which ascent and descent to or from either bridges or tunnels might be obtained, is by means of platform lifts, rising and descending by *counterpoise*—a mode particularly applicable in the present case, as the number and weight of ascents and descents would be the same, so that the only force requisite in addition to the weight of passengers would be that necessary for overcoming the friction of the apparatus. Wear and tear of these lifts would, however, be greater than that of an inclined plane.

The whole of a bridge might be covered with glass at little cost, thus affording a safe and clean retreat in showery weather. It might occasionally be crowded with idlers, as is the National Gallery, but without the mischievous consequences that, in the latter instance, result to the treasures of art that gallery contains.

M. S. B.

December 12, 1850.

THE GLASS MANUFACTURE.

So long as the duty on glass remained in force, it was not to be expected that experiments would be made with a view to improvements in the composition or manufacture of that material; but now that glass-making is altogether freed from the restraints it had been subjected to by the Excise Laws, it seems remarkable that no attempts have been made to ameliorate the material itself, to render it more applicable to new purposes, or to introduce machinery in lieu of manual labour in its manufacture, and of atmospheric air in lieu of the breath of man.

At the glass fabrics which Sir Samuel Bentham directed at Dubrovna, in White Russia, he made crucibles on the principle of Reaumur's porcelain, in which *brass* was *melted;* and other vessels of the same material which, when heated to a red heat, had cold water poured into them without being broken. Amongst his loose notes are the following:—

"De-vitrified materials—for example, such as are known by the name of Reaumur's porcelain.

"These materials, when in a vitrified state, are capable of being ground, turned, polished, by machinery; after which they may be de-vitrified, or otherwise changed by exposure to heat, with or without cementation.

"This material is beautiful, durable, and applicable to a great variety of purposes, as for many ornamental parts of houses—to domestic utensils, especially to those exposed to sudden changes from heat to cold, as cooking vessels, stoves, and fire-irons. Its cleanliness renders it desirable for such articles as spoons, cruet-frames, tea, and other trays: it might be introduced for a variety of small articles, as knife-handles; and would be beautiful and easily cleaned as legs of tables, and even for tables themselves."

In one of the little books in which Sir Samuel entered ideas as they occurred to him from the age of fifteen to twenty, there is the following item, under the head of "glass:"—

"Might not glass be blown by a bellows, or by a kind of bladder containing a *certain* quantity of air, and be pressed with a *certain* force, so as to make the vessel of a certain size?"

"There is wanting a method to turn glass while hot in a lathe."

"There might be a tube of iron turned round in a lathe, in one end of which tube should be inserted a smaller tube; on which the larger one should run: this tube might terminate in a bellows to blow in air; at the other end of this large tube the glass might be fixed."

These are evidently but crude ideas; but as brilliant inventions have often

sprung from even slighter indications, these may serve to turn attention to the application of machinery in the manufacture of glass.

Pottery being in some respects an analogous subject, and earthenware pipes being now for so many purposes preferred to those of iron, it may be of use to add a caution against the effects of vibration on earthenware. About fifty years ago, the proprietors of water-works for the supply of Devonport laid down pipes of pottery; they supported internal pressure under a considerable head of water, but those that passed under streets were soon broken by the vibration produced by the rattling of carriages over them.

M. S. B.

ON THE EFFECT OF PRESSURE IN LOWERING THE FREEZING-POINT OF WATER, EXPERIMENTALLY DEMONSTRATED. BY PROFESSOR W. THOMSON, GLASGOW.

(From the Proceedings of the Royal Society of Edinburgh.)

On the 2nd of January, 1849, a communication, entitled "Theoretical Considerations on the Effect of Pressure in Lowering the Freezing-Point of Water, by James Thomson, Esq., of Glasgow," was laid before the Royal Society, and it has since been published in the *Transactions*, vol. xvi., Part V. In that paper it was demonstrated that, if the fundamental axiom of Carnot's theory of the motive power of heat be admitted, it follows, as a rigorous consequence, that the temperature at which ice melts will be lowered by the application of pressure; and the extent of this effect due to a given amount of pressure was deduced by a reasoning analogous to that of Carnot from Regnault's experimental determination of the latent heat, and the pressure of saturated aqueous vapour at various temperature differing very little from the ordinary freezing-point of water. Reducing to Fahrenheit's scale the final result of the paper, we find

$$t = n \times 0{\cdot}0135;$$

where t denotes the depression in the temperature of melting ice produced by the addition of n "atmospheres" (or n times the pressure due to 29·922 inches of mercury), to the ordinary pressure experienced from the atmosphere.

In this very remarkable speculation, an entirely novel physical phenomenon was *predicted* in anticipation of any direct experiments on the subject; and the actual observation of the phenomenon was pointed out as a highly interesting object for experimental research.

To test the phenomenon by experiment without applying excessively great pressure, a very sensitive thermometer would be required, since for ten atmospheres the effect expected is little more than the tenth part of a Fahrenheit degree; and the thermometer employed, if founded on the expansion of a liquid in a glass bulb and tube, must be protected from the pressure of the liquid, which, if acting on it would produce a deformation, or at least a compression of the glass that would materially affect the indications. For a thermometer of extreme sensibility, mercury does not appear to be a convenient liquid; since, if a very fine tube be employed, there is some uncertainty in the indications, on account of the irregularity of capillary action, due probably to superficial impurities, and observable even when the best mercury that can be prepared is made use of; and again, if a very large bulb be employed, the weight of the mercury causes a deformation which will produce a very marked difference in the position of the head of the column in the tube, according to the manner in which the glass is supported, and may therefore affect with uncertainty the indications of the instrument. The former objection does not apply to the use of any fluid which perfectly wets the glass; and the last-mentioned source of uncertainty will be much less for any lighter liquid than mercury, of equal or greater expansibility by heat. Now the coefficient of expansion of sulphuric ether, at 0° C., being, according to M. I. Pierre,* ·00151, is eight or nine times that of mercury (which is ·000179, according to Regnault); and its density is about the twentieth part of the density of mercury. Hence a thermometer of much higher sensibility may be constructed with ether than with mercury, without experiencing inconvenience from the circumstances which have been alluded to. An ether thermometer was accordingly constructed by Mr. Robert Mansell, of Glasgow, for the experiment which I propose to make. The bulb of this instrument is nearly cylindrical, and is about 3½ inches long and three-eighths of an inch in diameter. The tube has a cylindrical bore about 6½ inches long; about 5½ inches of the tube are divided into 220 equal parts. The thermometer is entirely inclosed, and hermetically sealed in a glass tube, which is just large enough to admit it freely. On comparing the indications of this instrument with those of a thermometer of Crichton's with an ivory scale, which has divi-

* See Dixon on Heat, p. 72.

sions, corresponding to degrees Fahrenheit, of about one-twenty-fifth of an inch each; I found that the range of the ether thermometer is about 3° Fahr.; and that there are about 212 divisions on the tube corresponding to the interval of pressure from 31° to 34°, as nearly as I could discover from such an unsatisfactory standard of reference. This gives $\frac{1}{71}$ of a degree for the mean value of a division. From a rough calibration of the tube which was made, I am convinced that the values of the divisions at no part of the tube differ by more than one-thirtieth of this amount from the true mean value; and, taking into account all the sources of uncertainty, I think it probable that each of the divisions on the tube of the ether thermometer corresponds to something between $\frac{1}{68}$ and $\frac{1}{73}$ of a degree Fahrenheit.

With this thermometer in its glass envelope, and with a strong glass cylinder (Œrsted's apparatus for the compression of water), an experiment was made in the following manner:—

The compression vessel was partly filled with pieces of clean ice and water: a glass tube, about a foot long and one-tenth of an inch internal diameter, closed at one end, was inserted with its open end downwards, to indicate the fluid pressure by the compression of the air which it contained: and the ether thermometer was let down and allowed to rest with the lower end of its glass envelope pressing on the bottom of the vessel. A lead ring was let down so as to keep free from ice the water in the compression cylinder round that part of the thermometer tube where readings were expected. More ice was added above, so that both above and below the clear space, which was only about two inches deep, the compression cylinder was full of pieces of ice. Water was then poured in by a tube with a stopcock fitted in the neck of the vessel, till the vessel was full up to the piston, after which the stopcock was shut.

After it was observed that the column of ether in the thermometer stood at about 67°, with reference to the divisions on the tube, a pressure of from 12 to 15 atmospheres was applied by forcing the piston down with the screw. Immediately the column of ether descended very rapidly, and in a very few minutes it was below 61°. The pressure was then suddenly removed, and immediately the column in the thermometer began to rise rapidly. Several times pressure was again suddenly applied, and again suddenly removed, and the effects upon the thermometer were most marked.

The fact that the freezing point of water is sensibly lowered by a few atmospheres of pressure was thus established beyond all doubt. After that I attempted, in a more deliberate experiment, to determine, as accurately as my means of observation allowed me to do, the actual extent to which the temperature of freezing is affected by determinate applications of pressure.

In the present communication, I shall merely mention the results obtained, without entering at all upon the details of the experiment.

I found that a pressure of, as nearly as I have been able to estimate it, 8·1 atmospheres produced a depression measured by $7\frac{1}{2}$ divisions of the tube on the column of ether in the thermometer; and again, a pressure of 16·8 atmospheres produced a thermometric depression of $16\frac{1}{2}$ divisions. Hence the observed lowering of temperature was

$$\frac{7\frac{1}{2}}{71},$$

or ·106° F. in the former case, and

$$\frac{16\frac{1}{2}}{71},$$

or ·232° F. in the latter.

Let us compare these results with theory. According to the conclusions arrived at by my brother in the paper referred to above, the lowering of the freezing point of water by 8·1 atmospheres of pressure would be 8·1 × ·0135, or ·109° F.; and the lowering of the freezing point by 16·8 atmospheres would be 16·8 × ·0135, or ·227° F. Hence we have the following highly satisfactory comparison for the two cases between the experiment and theory:—

Observed Pressures.	Observed Depressions of Temperatures.	Depressions according to Theory, on the hypothesis that the Pressures were truly observed.	Differences.
8·1 Atmospheres.	·106° F.	·109° F.	—·003° F.
16·8 Atmospheres.	·232° F.	·227° F.	+·005° F.

It was, I confess, with some surprise that after having completed the observations under an impression that they presented great discrepancies from the theoretical expectations, I found the numbers I had noted down indicated in reality an agreement so remarkably close, that I could not but attribute it in some degree to chance, when I reflected on the very rude manner in which the quantitative parts of the experiment (especially the measurement of the pressure, and the evaluation of the division of the ether thermometer) had been conducted.

I hope before long to have a thermometer constructed which shall be at least three times as sensitive as the ether thermometer I have used hitherto; and I expect with it to be able to perceive the effect of increasing or diminishing the pressure by less than an atmosphere in lowering or elevating the freezing point of water.

If a convenient *minimum* thermometer could be constructed, the effects of very great pressures might easily be tested by hermetically sealing the thermometer in a strong glass, or in a metal tube, and putting it into a mixture of ice and water in a strong metal vessel, in which an enormous pressure might be produced by the forcing pump of a Bramah's press.

In conclusion, it may be remarked, that the same theory which pointed out the remarkable effect of pressure on the freezing point of water, now established by experiment, indicates that a corresponding effect may be expected for all liquids which expand in freezing; that a reverse effect, or an elevation of the freezing point by an increase of pressure, may be expected for all liquids which contract in freezing; and that the extent of the effect to be expected may, in every case, be deduced from Regnault's observations on vapour (provided that the freezing point is within the temperature limits of his observations), if the latent heat of a cubic foot of the liquid and the alteration of its volume in freezing be known.

BOILER EXPLOSION AT HALIFAX.—REPORT OF MR. FAIRBAIRN.

A coroner's inquest upon the bodies of ten persons who were lately killed by a boiler explosion at Messrs. Firth's woollen manufactory, Lily-lane Mill, Halifax, was brought to a close on Friday evening last. A great mass of evidence was adduced, the general tenor of which was, that Mr. Samuel Firth, if not other of the partners, was aware that the exploded boiler was unsafe for use, and yet that it was kept working at intervals up to the time of the explosion. Once or twice previous to the explosion the steam was turned off and the machinery stopped while Firth and the engine tenter tinkered at the boiler, which was constantly leaking; and on the day before the boiler burst Firth ordered the young people out of the engine-house (where they had been accustomed to warm themselves,) telling them that "they were to get away as fast as they could, lest the boiler should burst." The young people naturally became alarmed, and one of them—Lavinia Carter—attempted to leave the mill, but was ordered back by Samuel Firth, and shortly after her resuming work the explosion took place. This, however, was not the most serious part of the evidence against Samuel Firth. Mr. Thomas Wood, cotton spinner, of Sowerby-bridge, stated that two days before the explosion he met Samuel Firth in Bradford Cloth-hall, when Samuel said—referring to the explosion at Messrs. Waud's Bradford-mill—"We have had a good deal of bother about engineering this week. Our old engine is poorly, and I have had to look after the man a good deal, lest he should get his pressure too strong on the boiler. I am afraid there will be a blow-up at our place, but we must run on till Christmas." The most important evidence given during the inquiry was that of Mr. William Fairbairn, the eminent civil engineer and machinist, of Manchester, who had been sent for by the Mayor and Magistrates of Halifax to view Messrs. Firth's boilers and report thereon. His evidence is important, not only as showing how the accident occurred, but as suggesting a precaution against these dreadful catastrophes in future. Mr. Fairbairn put in a written report of considerable length, of which the following are the chief points:—

"The comparative saving which is effected by the judicious application of high-pressure steam in its expansive action upon steam engines, and when due care is taken that the vessels within which it is confined are calculated to resist with perfect security the forces by which they may be assailed, does not admit of doubt. I think it is equally for the general benefit of the country and the extension of our manufactures that every facility should be given for its introduction, and I take this opportunity publicly to state that in my opinion it may be accomplished with perfect safety and with greatly increased economy in the consumption and employment of the most valuable mineral production this country possesses. The danger does not consist in the intensity of pressure to which the steam may be raised, but entirely upon the character and construction

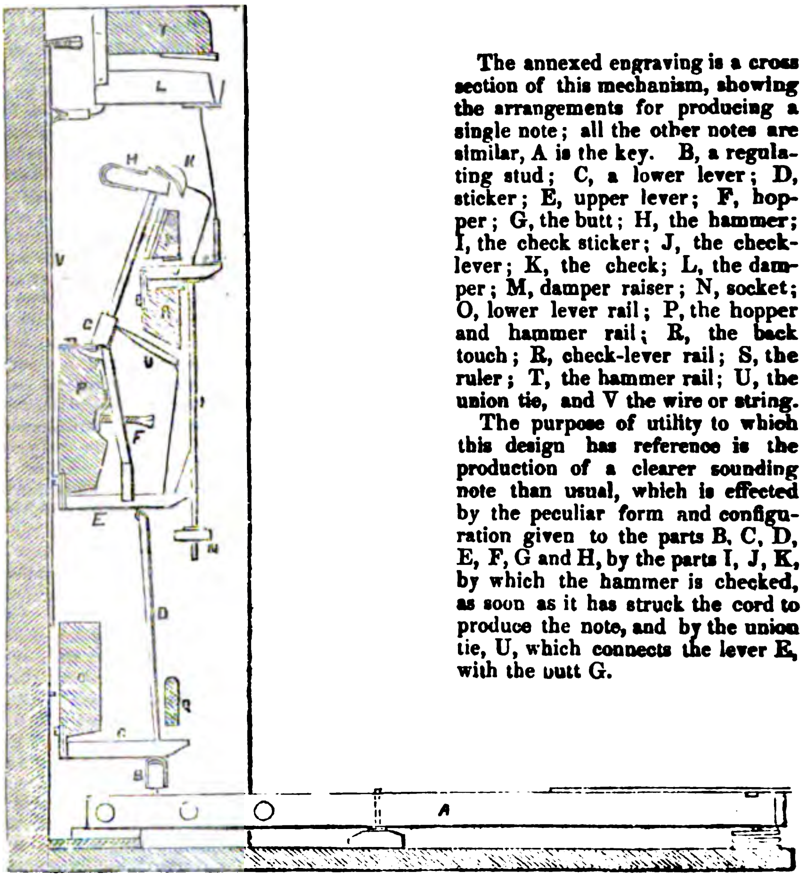
of the vessel which contains the dangerous element. When contained within the narrow limits of a well-constructed locomotive boiler it was perfectly harmless; but if it be attempted to enclose a volume of similar density in an ordinary boiler of extended capacity you incur the almost certain result of a catastrophe such as we have so very recently been called upon to deplore. Such it appears to me was the position in which the public were placed with respect to the boilers of the Lilly-lane Mill. They were worked (especially two of them) in a very unsafe condition; and I have no hesitation in stating that they were unequal to the pressure to which they were exposed. Insecure to begin with, they were rendered immeasurably more so from the absence of proper safety valves—an outlet of only 3 inches diameter, which was common to all the three, being scarcely worthy of the name. From every inquiry there is no evidence to show at what pressure the valve was weighted, or whether or not it was ever in a working condition. I am not aware what may be the practice in this or other parts of Yorkshire; but I cannot sufficiently condemn a system of construction which limits the means of escape, and exposes both life and property to the most imminent peril. The boilers at Lilly-lane Mill were of such magnitude, and the plates of which they were composed so extremely thin, that I should have considered them at any time very precarious. Assuming all the parts to be perfect—which is, however, doubtful—we shall find that 12 lbs. on the square inch was, although sufficient to distort the form, totally inadequate to effect the rupture of the boiler. Taking the tensile strength of the material, and the joints of which the boiler was composed, it was equal, under a more judicious distribution, to ten times that pressure; but unfortunately the extreme thinness of the plates, and the want of sufficient stays, caused the flat ends to bulge outwards, which, under the influence of a variable force, created a slow but certain strain upon the angle iron, which ultimately destroyed its texture, and rupture ensued. The boilers were originally supplied with water by self-acting jackheads or columns of water at the usual height of 12 or 14 feet. These, it appears, were taken down some years since, when the new end of the mill was built over the boilers, and valves or cocks worked by hand substituted for them. Now, the hand-feed, direct from the pump, in well-constructed cylinder boilers, with double-safety valves, may be perfectly safe; but in this case, when the steam escape was so insufficient, they were very injudicious, and, in fact, the removal of the jackheads did away with almost the only security that the boilers originally possessed. Before the engine is again started I would earnestly recommend that the boiler next the engine-house be discontinued and destroyed, and that the other boiler with hemispherical ends be removed from under the mill, if it is be possible to do so. Having made these statements it now becomes my duty to state, for the information of the authorities of Halifax and the public generally, what I consider the most feasible means for averting, or at least diminishing, the number of these frightful accidents arising from boiler explosions. It appears to me that a legislative interference in the construction of boilers or machinery of any kind is exceedingly objectionable, and should not be resorted to but in cases of urgent necessity; yet I do not clearly perceive how local regulations, however good and judicious in themselves, would answer the purpose, unless under the controul and sanction of the law. I apprehend the assistance of Parliament would be repuired to carry out the principles I would suggest, as follow:—1st. That after a certain date boilers should not be allowed to be placed under buildings where people are employed, and that those now in that position be as speedily removed as possible. 2nd. That boilers of a wagon-shape should not be worked at a pressure exceeding 10 lbs. on the square inch. 3rd. That after a certain date every new boiler should be proved up to not more than one-third its bursting pressure, and to three times its intended working pressure. Lastly, That every boiler should be fitted with two safety valves, one to be self-acting and beyond the reach of the engine tenter, or any other person but one to whom the duty of examination should be expressly intrusted."

After the evidence had been closed, the coroner (Mr. G. Dyson) having summed up, the jury retired, and after being in consultation for upwards of three hours, returned with a verdict of "Manslaughter against Samuel Firth, one of the propietors of the mill, and Joseph Helliwell, the engine-tenter."—*Times*.

Fine Spinning.—To such wonderful perfection have machinery and skill been brought, that Mr. H. Houldsworth is now able to produce 520 hanks of thread to the pound; that is to say, one pound of cotton-wool, weighing 7000 grains, is susceptible of giving 520 hanks, each being composed of a thread 840 yards in length; or 7000 grains of cotton-wool can give a thread equal in length to 436,810 yards, or 248 miles. The fine spinning of flax has also been carried to an extraordinary extent; for one pound of flax fibre is susceptible of being spun with hand-looms into a thread 84,496 yards, or 48 miles in length.

DIMOLINE'S COMPENSATION PIANOFORTE MECHANISM.

(Abraham Dimoline, of 6, Denmark-street, and Mark-lane, Bristol, Pianoforte Manufacturer, Proprietor.)



The annexed engraving is a cross section of this mechanism, showing the arrangements for producing a single note; all the other notes are similar, A is the key. B, a regulating stud; C, a lower lever; D, sticker; E, upper lever; F, hopper; G, the butt; H, the hammer; I, the check sticker; J, the check-lever; K, the check; L, the damper; M, damper raiser; N, socket; O, lower lever rail; P, the hopper and hammer rail; R, the back touch; R, check-lever rail; S, the ruler; T, the hammer rail; U, the union tie, and V the wire or string.

The purpose of utility to which this design has reference is the production of a clearer sounding note than usual, which is effected by the peculiar form and configuration given to the parts B, C, D, E, F, G and H, by the parts I, J, K, by which the hammer is checked, as soon as it has struck the cord to produce the note, and by the union tie, U, which connects the lever E, with the butt G.

EARLY HISTORY OF STEAM NAVIGATION.

The following quotation is from a letter of Jeremy Bentham to his brother Samuel, 22nd May, 1778.

"*Ledger*, *Tuesday*,
"*May* 19*th*, 1778.

"In consequence of the French Ambassador at Vienna having last summer invented a boat with wheels which are put in motion *by fire*, and which he made go up and down the Danube, a grand boat-race is to take place on the Danube for 1000 livres next month. Several mechanics, one of whom is a Venetian, *has* invented seven new boats to oppose the ambassador's. The swiftest boat is to have the prize."

Jeremy Bentham, in allusion to his brother's project (*Mech. Mag.*, No. 1371), adds, "Alas! poor fire-engine! Fie on the French Ambassador."

Who was the "French Ambassador" above alluded to? And are his experiments known to those conversant with the history of the steam engine?

M. S. B.

[Probably Comte d'Auxiron, who is recorded to have made some unsuccessful steam-boat experiments about this period.—*Woodcroft's Steam Navigation*, p. 14. Ed. M. M.]

NEW MODE OF ATTACHING SHIPS' CABLES.

Fig. 1.

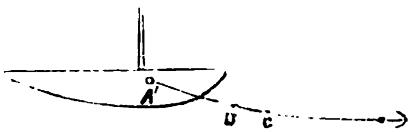
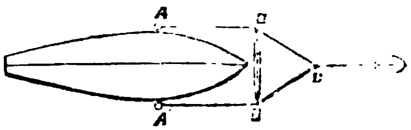


Fig. 2.



The above diagrams represent a new way of attaching ships' cables, whereby all straining of the cable and dragging of the anchor, in so far as caused by the pitching of the vessel, is entirely prevented.

Fig. 1 is an elevation, and fig. 2 a plan. The cable is to be fastened to the ship at or near its centre of buoyancy, instead of at the bow, as is the case at present. For this purpose ring-bolts A A′ are attached to the ship's sides on either side of the centre of buoyancy, to which are fastened the two ends of a short cable ABC B′A′. The anchoring cable is attached to the middle of the short cable at C. A stretcher BB′ prevents the ship's bows being chafed by the short cable.

It is easily seen that the pitching of the vessel has no tendency in this case to strain the cable or drag the anchor, both of which will remain unaffected in the wildest of these movements. I feel sanguine that a vessel anchored in this way would ride out the fiercest gales.

ROBERT AYTOUN.

REGISTRATION OF DESIGNS.

Rules and Regulations for the Provisional and Complete Registration of Designs, made, and published in the Gazette *of the 22nd of November*, 1850, *by order of the Right Honourable the Lords of the Committee of the Privy Council for Trade, by virtue of the power vested in them by "The Designs Act,"* 1850.

Designs Office, Dec. 2, 1850.

I. All persons desirous of effecting registration or provisional registration of any designs, must furnish to the Registrar (except in any case in which, under the 11th section of the Designs Act, 1850, he may dispense with any such particulars) two copies, drawings, or prints of such design, and, if such design is intended for exhibition at any place certified by the Lords of the said Committee to be a place of public exhibition within the meaning of the Designs Act, 1850,* then a third copy, drawing, or print also.

II. In the case of paper-hangings, calico prints, and other furnitures of such a nature as to admit of being conveniently pasted in a book, portions of such furnitures may, with the permission of the Registrar, be received for the purpose of registration, instead of the copies, drawings, and prints before mentioned.

III. Upon the face of the sheet containing such copy, drawing, or print, or if a portion of the article to be registered be furnished to the Registrar, as before provided, then, upon a sheet of paper attached thereto, or delivered therewith, must be set forth the name of every person claiming to be the proprietor of the design, or the style or title of the firm under which he trades, together with his place of abode, or place of carrying on his business, or other place of address; and also in the cases after mentioned the following further particulars (except where the Registrar may dispense with any thereof as aforesaid): that is to say:

1. If the registration of such design be sought in respect of the application thereof to ornamenting any article of manufacture or substance, there must, if the registration sought be complete registration, be set forth the number of the class or classes described in section 3 of the Designs Act, 1842, in respect of which the registration is made; or

2. If such design be for the shape or configuration of any article of manufacture having reference to some purpose of utility, the drawings or prints must be made on a proper geometric scale, and there must be set forth the title of the design, and such description thereof, in writing, as may be necessary to render the same intelligible, and the description must distinguish such parts of the design (if any) as are not new or original, and every such drawing or print, together with the title or description of such design, and the name and address of

* A notice has appeared in the *Gazette* certifying that the building in Hyde Park is a place of this description.—ED. M. M.

the proprietor must be on one sheet of paper or parchment, and on the same side thereof, and the size of such sheet must not exceed 24 inches by 15 inches, and there must be left on one of such sheets a blank space, on the same side on which are such drawing, title, description, name, and address, of the size of 6 inches by 4 inches, for the certificate hereinafter mentioned.

IV. All persons desirous of effecting registration of any sculpture, model, copy, or cast, within the protection of two several Acts, passed respectively in the 38th and 54th years of the reign of King George the Third, and intituled respectively "An Act for encouraging the Art of making new Models and Casts of Busts, and other things therein mentioned," and "An Act to amend and render more effectual an Act for encouraging the Art of making new Models, and casts of busts, and other things therein mentioned," which two Acts are in the said Designs Act, 1850, called the "Sculpture Copyright Acts," must furnish to the Registrar such copy, drawing, or print, or such description, writing, or print, as in the judgment of the Registrar shall be sufficient to identify the particular sculpture, model, copy, or cast, in respect of which registration is desired, and the name of the person claiming to be the proprietor, together with his place of abode or business, or other place of address, or the name, style, or title of the firm under which he trades.

V. The Registrar shall affix a number upon every such copy, drawing, print, or description of any design, sculpture, model, copy, or cast, so to be furnished to him as aforesaid, denoting the order in which the same has been received by him, and a corresponding number upon the duplicate and triplicate copy, drawing, print, or description directed to be furnished to him as aforesaid; and he shall register every such copy, drawing, print, or description, in the order in which it is received by him, by entering the number thereof, and also the title or class thereof, in a book to be kept by him for that purpose; and he shall keep a proper index of all the designs, sculptures, models, and copies or casts so registered, according to the titles thereof, or arranged in such classes as to afford ready access to the same.

VI. Whenever any such registration is made, the Registrar shall retain and file in his office one of the copies, drawings, prints, or descriptions hereinbefore required to be furnished to him, and he shall return the other thereof (when two only are furnished) to the person by whom the same was furnished, having first affixed thereon or attached thereto a certificate, whereby he shall certify under his hand and seal of office the fact of such registration, and the date, and the name of the registered proprietor, or the style or title of the firm under which he trades, together with his place of abode or business, or other place of address; and he shall cause the remaining copy, drawing, print, or description (when three have been furnished), having the certificate of provisional registration affixed thereon, to be deposited in the place of public exhibition so to be certified as aforesaid.

VII. Persons desirous of having the transfer of any registered design registered, must furnish to the Registrar the written transfer of such design, or other sufficient evidence of their title, together with a written request to register, to the effect set forth in the 6th section of the Designs Act, 1842, and the Registrar shall thereupon insert the name of the new proprietor in the register. If a certificate of the transfer be desired, the certified copy of the design, or an exact copy thereof, must be furnished to the Registrar for the purpose of having such certificate affixed thereon; and the Registrar shall accordingly affix thereon a certificate under his hand and seal of office, containing the like particulars as are herein required in the case of a certificate of the registration of a design.

VIII. Any person desirous of ascertaining whether with respect to any particular design there be any copyright existing, must produce to the Registrar such design, together with the registration mark thereof; or he may produce such registration mark only; or in the case of a design provisionally registered, the number thereof; and thereupon the Registrar shall give to such person a certificate under his hand and seal of office, stating whether there be any copyright of such design existing, and if there be, then in respect to what particular article of manufacture or substance such a copyright exists, and the term of such copyright, and the number and date of the registration thereof, and also the name and place of abode or business, or other address of the registered proprietor thereof.

IX. All the services hereinbefore directed to be performed by the Registrar are to be performed on payment of such fees as may be from time to time fixed by the Lords Commissioners of Her Majesty's Treasury.

[Since the issue of these "Rules and Regulations," we have received a notice from the Registrar that he will be prepared to receive Designs for Provisional Registration on and after the 1st of January next. The following official explanations of the Law and Practice, as they now stand under the different Acts, has also just been issued from the Designs Office.—Ed. M. M.]

Copyright of Designs for Articles of Utility.

By Provisional Registration under the Designs Act, 1850, (13 & 14 Vic., c. 104,) a Copyright for One Year, (which may be further extended for Six Months by order of the Board of Trade), is given to the Author or Propietor of any New or Original Design *for the* SHAPE *or* CONFIGURATION *either of the whole or of part of any Article of Manufacture, such* SHAPE *or* CONFIGURATION *having reference to some* PURPOSE *of* UTILITY, whether such Article be made in Metal or any other Substance. During such terms the Proprietor of the Design may sell the right to apply the same to an article of manufacture, but must not, under the penalty of nullifying the Copyright, sell any article with the Design applied thereto, until after Complete Registration, which must be effected *prior to the expiration* of the Provisional Registration.

By Complete Registration under the Designs Act, 1843, (6 & 7 Vic., c. 65,) a Copyright of THREE YEARS is given to the Author or Proprietor of any new or original design *for the* SHAPE *or* CONFIGURATION *either of the whole or of part of any Article of Manufacture, such* SHAPE *or* CONFIGURATION *having reference to some* PURPOSE *of* UTILITY, whether such Article be made in Metal or any other Substance.

To obtain this protection, it is necessary—

1st. That the Design should *not have been published* either within the United Kingdom of Great Britain and Ireland, or elsewhere, previous to its Registration.

2nd. That after Registration, or Provisional Registration, every Article of Manufacture made according to such Design, or to which such Design is applied, should have upon it the word "REGISTERED, or PROVISIONALLY REGISTERED," *with the date of Registration.*

In case of Piracy of a Design so Registered, the same remedies are given, and the same penalties imposed (from 5*l.* to 30*l.* for each offence), as under the Ornamental Designs Act, 1842, (5 & 6 Vic., c. 100,) and all the provisions contained in the latter Act relating to the Transfer of *Ornamental* Designs, in case of purchase or devolution of a Copyright, are made applicable to those *useful* Designs registered under these Acts.

In addition to this, a penalty of not more than 5*l.* nor less than 1*l.* is imposed upon all persons making, selling, or advertising for sale any Article as "Registered," unless the Design for such Article has been registered under one of the *above-mentioned Acts.*

Copyright of Designs for Ornamenting Articles of Manufacture.

By Provisional Registration under the Designs Act, 1850, (13 & 14 Vic., c. 104,) a Copyright of One Year (which may be further extended for six months by order of the Board of Trade) is given to the Author or Proprietor of Original Designs for Ornamenting any Article of Manufacture or Substance. During such terms the Proprietor of the Design may sell the right to apply the same to an article of manufacture, but must not, under the penalty of nullifying the Copyright, sell any article with the Design applied thereto, until after Complete Registration, which must be effected *prior to the expiration* of the Provisional Registration.

By Complete Registration under the Designs Act, 1842, (5 & 6 Vic., c. 100,) a Copyright or Property is given to the Author or Proprietor of any New or Original Design for Ornamenting any Article of Manufacture or Substance for the various Terms specified in the following Classes :—

1.	Articles composed wholly or chiefly of Metal	3 years	£3	0
2.	Articles do. do. do. Wood	3 ,,	1	0
3.	Articles do. do. do. Glass	3 ,,	1	0
4.	Articles do. do. do. Earthenware, Bone, Papier Maché, or other solid substances not comprised in Classes 1, 2, and 3	3 ,,	1	0
5.	Paper Hangings	3 ,,	0	10
6.	Carpets, Floor Cloths, and Oil Cloths	3 ,,	1	0
7.	Shawls (patterns printed)	9 mths.	0	1
8.	Shawls (patterns not printed)	3 years	1	0
9.	Yarn, Thread, or Warp (printed)	9 mths.	0	1
10.	Woven Fabrics (patterns printed, except those included in Class 11)	9 ,,	0	1
11.	Woven Fabrics, Furnitures (patterns printed, the repeat exceeding 12 inches by 8 inches)	3 years	0	5
12.	Woven Fabrics (patterns not printed)	12 mths.	0	5
	Do. Damasks, Copyright extended to	3 years	1	0
13.	Lace, and all other Articles	12 mths.	0	5

MR. BILLS'S SOLUTION OF EQUATIONS.

Mr. Editor,—Before I make some remarks on Mr. Bills's communication respecting an extension of Horner's method, I am desirous of being supplied with *an example or two of the details of his process.* I therefore submit to his attention the two following equations for solution. They have nothing peculiar or critical about them; and they are simply chosen because I happen to have the means of verification at hand:

(1.) $x^2-4{\cdot}025x+6=0.$

(2.) $x^5+7x^4+20x^3+155x^2-1000=0.$

I will add this information (to save Mr. Bills the trouble of checking by the ordinary method) that the initial figures of the roots of the first equation are

$$2{\cdot}\ldots\pm1{\cdot}\ldots\sqrt{-1}.$$

I wish to see this worked out in detail, and the process explained. In the second, I wish to see how he separates the roots, and determines the initial figures; and then to see his approximation to any one of the imaginary roots.

I am, Sir, yours, &c.,

P. Q.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING DECEMBER 12, 1850.

JAMES PALMER BUDD, of the Ystalyfera Iron Works, Swansea, merchant. *For improvements in the manufacture of coke.* Patent dated June 11, 1850.

Mr. Budd observes that all coals may be divided into two classes; viz., those which on the application of heat run into a mass, and those which under similar circumstances splinter and separate into small pieces without uniting. The latter class, when reduced below a certain size, are almost valueless, and the object of the present invention is to render such coals available for coking purposes, which is effected by mixing with them bituminous coal possessing in as high a degree as possible the quality of caking, and subjecting them when so mixed to the ordinary process in use for coking bituminous coal. Both sorts are to be reduced to a state of powder by grinding in a pug mill, or the lumps are to be separated by sieves. The most refractory anthracitic coal may thus (it is said) be converted into coke of a good quality. No proportions of either can be laid down as a general rule, the non-caking coals possessing this quality in different degrees; but it is recommended to mix the two sorts at first in equal quantities, and to increase or diminish the quantity of either until coke be produced which presents on fracture a homogeneous appearance throughout.

Claim.—The coking of non-caking coals by the mixture of caking coals, the two sorts being intimately mixed together and reduced in size by grinding, rolling, or by abstraction of the lumps by sieves or other means.

JOHN DEARMAN DUNNICLIFFE, of Hyson Green, Nottingham, lace manufacturer, and JOHN WOODHOUSE BAGLEY, of Radford, in the same county, lace-maker. *For certain improvements in lace and other weavings.* Patent dated June 11, 1850.

Claims.—1. Certain improvements in the manufacture of weavings in warp frames or machinery, by employing the qualities of silk known by the names of fine French and fine Italian when working the class of lap, technically known as "the simplicity lap."

2. A peculiar method of manufacturing silk fabrics.

3. The manufacture of lace and other weavings in warp frames or machines when employing two threads to a needle, as described.

4. The employment of two or more coloured threads in weaving cut-pile fabrics in warp frames or machines, the ground of such fabrics being made of cotton.

5. The manufacture of double lace and other weavings in twist-lace machines.

6. A method described of manufacturing lace with weavings in twist-lace machines, and the making of "purle" edging to lace and other weavings made in twist-lace machines.

SAMUEL ELLIS, of Salford, engineer. *For improvements in machinery or apparatus applicable to all kinds of carriages used on railways.* Patent dated June 11, 1850.

The "machinery or apparatus" referred to consists of an additional set of wheels so arranged as to admit of the carriage being moved from one line to another at any point where a transverse line of suitable gauge intersects the main line.

A crank worked by a worm and worm wheel, or a rack and pinion, serves to raise the ordinary running wheels, at the same time that it brings the transverse ones to bear. When the carriage has been moved, the reverse motion of the crank raises the transverse wheels, and throws the weight of the carriage back on the running wheels, which are by this time in their desired position on the second line or siding.

Claim.—The constructing and arranging of apparatus, and adapting the same to carriages on railways in such manner that when the wheels for traversing the carriage from one line of rails to another are brought to bear on the transverse rails, the ordinary running wheels will be taken off their bearing on the lines of rails, and

when the wheels for traversing the carriage from one line of rails to another are taken off their bearing on the transverse rails, the ordinary running wheels will be brought to bear on the lines of rails.

ROBERT WADDELL, of Liverpool, Lancaster, engineer. *For certain improvements in steam engines.* Patent dated June 11, 1850.

The objects of the present improvements are—

1. To provide an outlet or means of escape for any water that may have accumulated either in the cylinder or steam pipe, from the priming of the boiler, from condensation, or from any other cause; and

2. To regulate the velocity of the engine when, from the withdrawal of resistance, the steam possesses an unequal elastic force, and exerts an undue pressure in different parts of the steam pipe, its condition being then what is termed "wire-drawn."

Mr. Waddell describes two arrangements of apparatus calculated to overcome the first of these difficulties; the principle is, however, in both cases the same. The cylinder or steam pipe has attached to it a chamber provided with two valves, which are maintained in equilibrio against the pressure of steam inside by the atmospheric air, aided by a counter weight. The accumulation of water in the chamber destroys this equilibrium, which is, however, again restored after it has escaped.

In the second case an additional throttle valve is employed, which is brought into action when the equilibrium of a piston placed in a chamber attached to the steam pipe is destroyed, by the steam on one side possessing a greater elastic force than that on the other. This additional valve is equally applicable to engines in which the throttle valve is worked by the governor or by hand gear, as is the case in marine engines.

Claims.—1. The use of a valve or valves acting (for the purpose mentioned) by the gravity of the water they are intended to discharge.

2. The application to steam engines of an additional throttle valve capable of being brought into action by a difference in the elastic force of the steam existing at the same time in the steam pipe.

PETER ARMAND LECOMTE DE FONTAINEMOREAU, of South-street, Finsbury. *For certain improvements in the manufacture of soda, muriatic, and nitric acids.* (A communication.) Patent dated June 11, 1850.

Claims.—1. The application of the sulphates of alumina and iron to the decomposition of sea salt, and of all nitrates and chlorides.

This operation is conducted by heating to a dull red (at which point perfect decomposition commences) pyritic schistus or alum clay in which lixiviation and calcination have developed the formation of sulphate of alumina and iron, either in combination with chloride of sodium or the nitrates of lime, soda, and potash. Steam or water is introduced into the furnaces to facilitate decomposition.

2. The employment of chlorides of manganese, calcium, and magnesium, to extract from them muriatic acid. When the muriatic acid meets a ready sale, the aforesaid chlorides may be advantageously employed, in combination with the sulphate of alumina and iron, to produce it economically.

3. The manufacture of sulphate of soda, muriatic and nitric acids, based on the transformation of the hydrosulphuric acid produced in the decomposition of nitrates and chlorides [into sulphuric acid, which is employed in the ordinary manner in such manufacture]. The hydrosulphuric acid serving for this manufacture being produced indirectly by the decomposition of the sulphurets of barium and calcium, of the produce of the evaporation of the lixiviation of artificial soda or by any process whatever.

(This specification is overrun with clerical errors, and excessively vague in its description of the different processes; so that we are by no means sure of having collected accurately the patentee's meaning.)

JOHN STOPPORTON, of the Isle of Man, engineer. *For certain improvements in propelling vessels.* Patent dated June 12, 1850.

This propelling apparatus consists of two or four cylinders placed horizontally in the vessel with their ends protruding into and open to the water. The piston-rods of these cylinders, to which are attached also the pistons of the steam cylinders, work through air and water-tight stuffing-boxes in their ends, the space between which and pistons may be either a vacuum or contain air; the advantage of each being about equal. The outward stroke of the piston ejects the water contained in the cylinder against the external water, and thus imparts a progressive motion to the vessel. To render both the outward and return stroke of the piston available, Mr. Stopporton proposes to construct the cylinders in the form of a syphon, each end being open, and the water entering at one end as it is expelled at the other.

The patentee also describes a mode of packing the pistons and stuffing-boxes, which he considers to be new.

Claims.—1. The method described of propelling vessels by means of pistons and cylinders applied and arranged as described.

2. The new description of packing for pistons and piston-rods.

[The first part of this invention is of very venerable antiquity, and has been revived times without number; the second is of no value apart from the other.]

JOHN HENRY VRIES, of Norfolk-street, Strand, Esq. *For improvements in working engines by atmospheric air.* Patent dated June 11, 1850.

The improved pneumatic engine which forms the subject of this patent embodies certain new principles said to have been discovered by its inventor, and is stated to be applicable to all motive purposes for which steam is at present employed. Various modifications of it are shown as adapted to stationary, marine, rotary, railway, and common-road locomotive engines; but the patentee, nevertheless, lays no claim to any particular mechanical arrangement for carrying his invention into effect. The principle on which such engines are constructed is the giving motion to a fly-wheel and shaft or other ponderous bodies, and causing them to revolve by means of the impulse to be derived from the momentary action and impetus obtained from the escape of small quantities of highly-compressed air in rapid succession, and from this first motion to form a connection by means of wheels, levers, or any of the other methods in common use, so as to work a force pump or pumps for the purpose of gradually compressing air into the receiver from which the escape has been allowed. The escape valve and force pumps must be so proportioned and constructed that more air may be compressed into the receiver than is consumed by the escape of the air therefrom. Then, in proportion to the height of condensation or density of the air used in giving these impulses, so much the more super (surplus?) power will be generated, which may be taken from off the first mover by any of the ordinary methods, and applied to any of the mechanical purposes to which the steam engine or any other prime mover is applicable.

After giving us this insight into the principles of his improvements, the patentee proceeds in a most laudatory style to enumerate the advantages possessed by this construction of engines over those at present in use, both as regards simplicity, economy in the first cost, compactness, and so on *ad infinitum*—advantages which, for the patentee's sake as well as that of mankind at large, it is to be hoped are not purely hypothetical.

JOHN SIDEBOTTOM, of Broadbottom, Chester, manufacturer. *For improvements in looms for weaving.* Patent dated June 11, 1850.

Mr. Sidebottom's improvements, as described and claimed, are—

1. A novel combination of parts of a loom for driving the shuttle from one box of the lathe to the other opposite one, without the intervention of straps or bands for that purpose, which wear so as soon to become useless.

2. A novel combination of discs carrying the teeth of temples for keeping the selvages of the cloth distended, and at a proper distance apart during the operation of weaving.

ALEXANDER PARKES, of Pembrey, Caermarthenshire, experimental chemist. *For improvements in smelting and treating certain metals, and in the construction and manufacture of furnaces and the materials to be used for the same, such furnaces and materials being applicable to the treatment of metals and metallic compounds, and to various other useful purposes of a like nature.* Patent dated June 11, 1850.

Mr. Parkes describes, first, an arrangement of apparatus applicable to furnaces employed for smelting purposes. This consists of an upright hollow iron shaft suitably supported in the centre of a circular furnace, and provided with the necessary wheel gearing for imparting a slow rotary motion. From this shaft extend arms which carry scrapers extending downwards to within an inch of the sole of each floor, so that the revolution of the shaft causes the scrapers to agitate the ore undergoing the process of calcination.

Claim.—The employment of an apparatus moving over a fixed floor, so as to agitate the mass during the process of calcination, and also the use for such purposes of a hollow iron shaft with solid or hollow arms, and provided with holes for the admission of air during the process.

The second improvement specified relates to the extraction of silver from lead ore. Assuming the proportion of silver to be from 100 to 200 oz. to the ton of lead, it is proposed to add to this quantity, while in a state of fusion, about 1 cwt. of zinc; and then, after stirring the whole well together, to reduce the temperature as low as possible without affecting the fluidity of the mass. The zinc abstracts or combines with the silver, and as soon as the mixture begins to set, it is to be ladled off; and as this quantity is sufficient to take up 400 to 500 oz., it may be again melted and used in a similar manner. The silver is separated from the zinc by dissolving the latter in sulphuric or muriatic acid, which precipitates the silver in a metallic state. No claim is, however, made to this process.

A third improvement claimed is the com-

bination of sulphate of lime or baryta, or carbonate or caustic lime, with silex or quartzeous materials to be formed into bricks for fire purposes; such bricks or other forms being particularly applicable to the construction of furnaces to be employed in the smelting of metals, and for various other useful purposes.

Lastly, Mr. Parkes proposes, when burning anthracite or stone coal, to introduce jets of steam; with reference to which, however, he merely claims the peculiar mode described of dividing the steam into jets, as calculated to ensure its ready decomposition. The steam he prefers to use is high-pressure steam, which he conveys to the fire-places through pipes parallel to and underneath the bars. The pipes are placed about four inches apart, and are perforated with holes of the thirty-second part of an inch diameter. This arrangement is stated to be particularly applicable to steam boilers and evaporating furnaces generally.

George Allen Everitt, of the firm of Allen Everitt and Son, of the Kingston Metal Works, Birmingham, metal and tube manufacturers, and George Glydon, of Birmingham, aforesaid, engineer and foreman to the said Allen Everitt and Son. *For certain improvements in the manufacture of metal tubes for locomotive, marine, and other boilers.* Patent dated June 12, 1850.

The intense heat to which the tubes of locomotive and other boilers are subjected, especially at one end, causes them to become worn out at that end, and consequently useless before the whole of their length is unserviceable. Now the present patentees propose to introduce at one end a short length of tubing, the effect of which will be to obviate the inconvenience above alluded to. This inserted tube will answer instead of a ferrule, or may be employed with one in the manner customary.

Claim.—The application in one end of boiler tubes of a shield or short tube, whose length exceeds twice its diameter, but it is less than half the length of the tube into which it is introduced.

William Edward Newton, of Chancery-lane, civil engineer. *For improvements in rotary engines.* (A communication.) Patent dated June 11, 1850.

The present improvements consist in packing the ends of the steam-wheel or piston and the cylinder-head of rotary engines with a metallic ring at each end fitted to the face of the steam wheel, and adapted so as to slide in an annular groove in the cylinder-head, or end of the casing which incloses the steam wheel. The packing ring is connected with a series of segmental wedges interposed between it and the cylinder-head. Each of the wedges is adapted to slide radially, and is coupled with a screw shaft or spindle, which is free to slide endwise in a pinion, the series of pinions being so arranged as to be simultaneously turned in either direction by a cog-wheel on the main-shaft of the engine. The cog-wheel is actuated by means of a worm or thread, or its mechanical equivalent, on the shaft of a hand-wheel, so that by turning the latter, the series of segmental wedges may be drawn towards or caused to recede from the centre, and will thus by their peculiar form press the packing towards the face of the steam wheel or release it from such pressure.

This method of arranging the packing is applicable to all kinds of rotary engines, and possesses the advantage of being entirely under the control of the engineer during the working of the engine, or before starting; so that in the event of any inequality existing in the expansion of the various parts of the engine, the readiness with which the packing can be adjusted offers every facility for avoiding the extremes of too great binding or too much leakage.

Claim.—The method, substantially as described, of regulating the packing-ring interposed between the steam-wheel and head of the cylinder, or outer casing of rotary engines, by combining with the said packing-ring a series of segmental wedges operated simultaneously in manner substantially as described.

William Edward Newton, of Chancery-lane, civil engineer. *For improvements in machinery for carding cotton, wool, and other fibrous materials, and in apparatus for preparing or setting the cards of carding engines.* (A communication.) Patent dated June 11, 1850.

The present improvements consist in covering the cylinders, drums, or rollers to which cards are to be attached with layers of paper, and also in similarly treating and preparing rollers used in grinding cards, and whose surfaces are required to be covered with emery or other similar material. The frame of the cylinder may be of the ordinary construction, and the cylinder itself composed of wrought or cast iron. In the former case, there are generally inequalities, which may be partially removed by hammering, after which a coat of paint is applied, and the whole surface well sprinkled with fine sifted sand. On this is placed a layer of composition, composed of glue and sand, of a consistence such as will admit of its being spread with a trowel. When this coating is partially dry, the cylinder is placed in a lathe, and turned as nearly true as may be. The surface is next to be covered with

sheets of paper, caused to adhere by means of a mixture of glue and gum arabic. When a sufficient thickness of paper has been thus laid on and allowed to dry, a second coating of the glue and sand composition is applied, and the surface turned true as before. Finally, the whole is covered with a sheet of paper laid carefully on, and cemented with cold starch, after which the cylinder has a couple of coats of varnish, and is then ready for use. The cards may be nailed on as usual, or screwed, if in fillets, in which case the roller will not require to undergo all the before-mentioned processes, as the fillets are attached to the ironwork.

Grinding rollers are prepared according to the above described method, but it is preferred to coat them with paint instead of varnish, as being more suited to receive and retain the emery, or other grinding powder, with which they are to be sprinkled.

Claims.—1. The covering of cylinders, drums, or rollers, employed in the operation of carding with a layer or layers of paper, as above set forth.

2. The covering of rollers used for grinding or setting the cards of carding engines with a layer or layers of paper, on which emery or other such substances may be applied. And also the combination of the operations above described for obtaining a suitable cylindrical surface on the cylinders, drums, or rollers of carding engines, and on the rollers employed in setting or grinding wire cards.

WILLIAM JACKSON, of Kingston-upon-Hull, soap-maker. *For improvements in the manufacture of soap, and in the preparation of materials to be used for this purpose.* Patent dated June 11, 1850.

The present improvements consist, in the words of the claims—

1. In "washing, for the purpose of purifying, resin in alkaline solutions of potash and soda, for the use of soap-makers."

2. In "charging such washed resin with potash or soda-ash." And

3. In "mixing the washed resin prepared as described with finished soap, in a fluid state, in the frames or any other vessel."

In carrying out the first operation, Mr. Jackson employs a wrought or cast-iron pan about five feet in diameter and three feet deep, set in brickwork, with a fire-place underneath. In the pan is laid a coil of pipe, perforated with small holes, and in communication with a steam boiler, but provided with a tap to regulate and shut off at pleasure the ingress of steam. Previous to lighting the fire, 10 cwt. of resin, broken in pieces or in coarse powder, are placed in the pan, which is also nearly filled with water. Heat is then applied until the resin and water are in a boiling state, when the fire is to be raked out, or its action on the pan prevented by the interposition of a damper. Steam is now admitted, and the liquid, to which about twenty gallons of soap-makers' lees have been added, is kept at a boiling heat for twenty or thirty minutes, after which the resin is allowed to subside, which it generally does in a few minutes; but if it be in excess, then the addition of about 20 lbs. common salt, quickly causes its precipitation, and the water (which will have acquired a dark red colour, and a slightly alkaline taste) drawn off. A fresh quantity of lees and water is then introduced, the steam turned on, and the whole again boiled, the operation being repeated four or five times, when the resin will be found on cooling to present the appearance of common yellow resin, and to be rather tough and hard.

In the second operation, the resin after being heated with sufficient alkaline lees to saturate or saponify it, is allowed to cool, and then mixed with potash or soda ash containing 50 per cent. alkali in the proportion of 20 lb., more or less of soda ash to the 1 cwt. of resin, the whole being well-stirred together to effect its complete incorporation.

The third process is effected in a manner similar to that in which water is at present mixed with finished soap in a fluid state, the resin being introduced into the frames or other vessel in the proportion of 3 to 500 lbs. for each ton of soap.

WILLIAM MAC LARDY, of Manchester, machinist. *For certain improvements in machinery or apparatus for preparing, and finishing, and doubling cotton and other fibrous materials.* Patent dated June 12, 1850.

Claims. — 1. (With reference to the machines commonly known as "drawing frames.") The application to the "stop-motion spoons" of two or more surfaces, in contact with which the sliver of cotton or other material passes.

2. (With reference to "throstle frames" and "doubling frames.") Connecting the spindles to the wharves by which they are driven, in such manner that the said spindles may be lifted free from the wharves, for the purpose of doffing the bobbins. Also, mounting the wharves of "throstle frame" and "doubling frame" spindles in independent bearings, for the purpose of preventing vibration.

3. (With reference to the method of spinning known as the "ring and traveller.") A new system of driving the traveller positively round the ring by means of a revolving flyer, or other suitable instrument.

Thomas Deakin, of Balsall Heath, Worcester, Esq. *For certain improvements in machinery or apparatus to be used in rolling metals, and in the manufacture of metal tubes.* Patent dated June 12, 1850.

The present improvements as described and claimed, are

1. The construction and arrangement of machinery for manufacturing tubes, wherein the skelp, or plate of metal is operated upon by a series of rollers by which the metal is bent up and welded to the form of a cylindrical tube at one or more operations of the machinery.

2. A method of manufacturing taper tubes by the employment of rollers having grooves therein of varying size.

3. A method of forming the grooves of rollers employed in the manufacture of taper tubes or solid bars of metal of regular varying size, by means of a traversing cutter.

4. A mode of forming and shaping metal tubes to be employed as railway rails, and for various other purposes.

The desired form is given by means of rollers suitably disposed, and geared, and having their peripheries grooved to impart any required form to the tube subjected to their action.

5. A method of manufacturing spiral or helical tubes or solids, by means of cylindrical or taper rollers, having spiral or helical grooves on their peripheries or surfaces, as described.

6. The employment of such machinery as is described for producing solid metal spirals or heliees.

Gustavus Palmer Harding, of Bartlett's-buildings, London, artificial florist. *For improvements in the manufacture of buttons and other fastenings.* Patent dated June 12, 1850.

Mr. Harding's improvements consist in attaching to buttons, studs, and other similar articles, a flat coil of wire, which acts as the fastening. An eylet or metal-bound hole is made in the article to which the button is desired to be fastened, the end of the coil is then introduced, and the button turned round until the whole of the coil has passed through. A modification of this principle renders it applicable to brooches and buttons with shanks.

Claims.—1. The method described of constructing the fastening in combination with buttons, studs, brooches, and such like articles,

2. The method described of making fastenings for buttons with shanks.

John Manby, Jun., of Birmingham, manufacturer. *For certain improvements in the manufacture of nails.* Patent dated June 12, 1850.

The improvements claimed in the present specification, are

1. The manufacture of nails having ornamental heads produced by the combined processes of casting and stamping.

2. The manufacture of nails having ornamental heads produced by covering them with an ornamental metallic shell, or covering attached to them by dies, or by pressure.

3. The stamping of tinned malleable iron nails in polished dies, thereby dispensing with the process of burnishing, and also the making of bronzed or blued nails from malleable and other iron, as described.

4. The method described of facilitating the stamping of the heads of nails; namely, by covering the nails with a film of soap.

5. The manufacture of nails having heads covered with a fabric or non-metallic covering material, whether the said covering be effected by the process described or by any other process in which the several parts of the nail are put together by dies, or by pressure.

6. The manufacture of nails having heads of horn or paper.

7. The ornamenting the heads of nails by winding thereon silk or other thread after the manner pursued in the manufacture of "leek silk buttons."

8. The manufacture of nails having ornamental heads produced by attaching thereto any fabric or flexible non-metallic covering material or vegetable fibre (such as is used in the manufacture of flock paper-hangings,) by means of any suitable adhesive matter according to the methods explained.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Charles Cowper, of Southampton-buildings, Chancery-lane, patent agent, for improvements in the manufacture of tiles. (Being a communication.) December 19; six months.

David Auld, of Glasgow, engineer, for certain improvements in steam engines, and in the working of steam boilers or generators, and in apparatus connected therewith. December 19; six months.

Sebastiano Botturi, of No. 7, Place de la Bourse, Paris, civil engineer, for certain improvements in machinery and apparatus for elevating fluids, and in their application as a motive power. December 19; six months.

Adolphus Oliver Harris, of High Holborn, philosophical instrument maker, for improvements in barometers. (Being a communication.) December 19; six months.

George Henry Bachhoffner, of Grove-road, St. John's Wood, Middlesex, and Nathan Defries, of Grafton-street, Fitzroy-square, civil engineer, for improvements in obtaining light and heat, and in apparatus connected therewith. Dcecember 19; six months.

Edward d'Orville, of Manchester, merchant, and John Partington, of Wichen Hall, near Rochdale, in the same county, bleacher, for certain improvements in finishing thread or yarn. December 19; six months.

Henry Mortlock Ommanney, of Chester, Esq., for certain improvements in the manufacture of steel. December 19; six months.

John George Taylor, of Great St. Thomas Apostle, London, merchant, for improvements in the manufacture of dress and other pins, and other dress fastenings and ornaments. December 19; six months.

William Henry Green, Basinghall-street, London, gentleman, for improvements in the preparation of peat and other ligneous and carbonaceous substances, and in the conversion of some of the products derived thereby, and in the mode of their application to the preservation of substances liable to decomposition and destructive agencies, and which mode is also applicable to other products of a similar nature. (Being a communication.) December 19; six months.

Philip Nind, of Leicester-square, gentleman, for improvements in the manufacture of sugar, and in cutting and rasping vegetable substances. (Being a communication.) December 19; six months.

John Henry Pape, of Paris, for improvements in musical instruments. December 20; six months.

William Herbert Gossage, of Stoke Prior, Worcester, chemist, for improvements in the concentration of sulphuric acid and certain other fluids; also in the use of a certain product or certain products sometimes obtained in manufacturing sulphuric acid and sulphurets. December 20; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF OCTOBER TO THE 22ND OF NOVEMBER, 1850.

Etienne Masson, of Place St. Michel, Paris, Gardener to the Central Society of Horticulture of France, for improvements in the preparation of certain vegetable alimentary substances, for the provisioning of ships and armies, and other purposes where the said substances are required. October 25; six months.

Zacariah Morley, of Regent's-park, Middlesex, Esq., for certain improvements in the means or methods of, or apparatus or machinery for decomposing water, and applying the products to useful purposes. (Being a communication.) October 28; six months.

Robert Lucas, of 3, Furnival's-Inn, Middlesex, mechanical draughtsman, for improvements in telegraphic and printing apparatus. (Being a communication.) October 31; six months.

George Michiels, of London, gent., for improvements in treating coal, and in the manufacture of gas, and also in apparatus for burning gas. November 5; six months.

William Henry Ritchie, of Kennington, Surrey, gent., for improvements in stoves. November 6; six months.

Peter Spence, of Pendleton, Manchester, manufacturing chemist, for improvements in the manufacture of alum, and certain alkaline salts, and in the manufacture of cement, part of which improvements are applicable in obtaining volatile liquids. November 7; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Dec. 11	2580	G. Turton	Wolverhampton	Flooring cramp.
,,	2581	Walker Brothers	White Lion-street	Utrolibet carriage.
,,	2582	Francis Cranmer Penrose, & George Forrester Bennett	Trafalgar-square	Sliding helicograph.
13	2583	R. and J. Rankin	Liverpool	Parts of machinery for cleansing grain or seeds.
,,	2584	Abraham Dimoline	Bristol	Compensation pianoforte mechanism.
14	2585	Luke Brierley and Thomas Beech	Birmingham / Shelton	Vertical revolving disc signal lamp.
16	2586	Thomas De La Rue and Co.	Bunhill-row	Edges of envelopes.

NOTICE TO CORRESPONDENTS.

A. B. *Not published anywhere in this country; but everything material has been given in the Magazine "The Facts in Corroboration" will be acceptable.*

CONTENTS OF THIS NUMBER.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1429.] SATURDAY, DECEMBER 28, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

BARLOW'S PATENT IMPROVEMENTS IN THE JACQUARD LOOM.

Fig. 1.

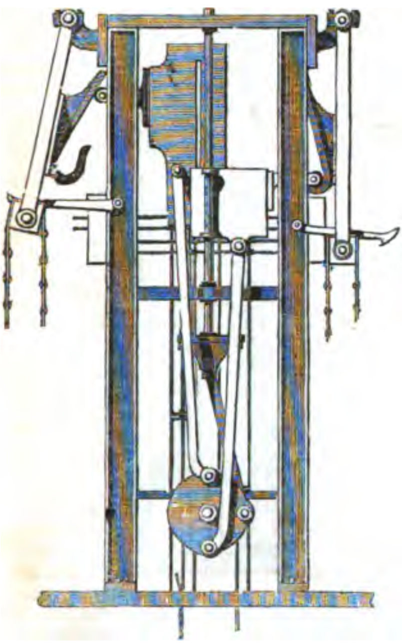


Fig. 2.

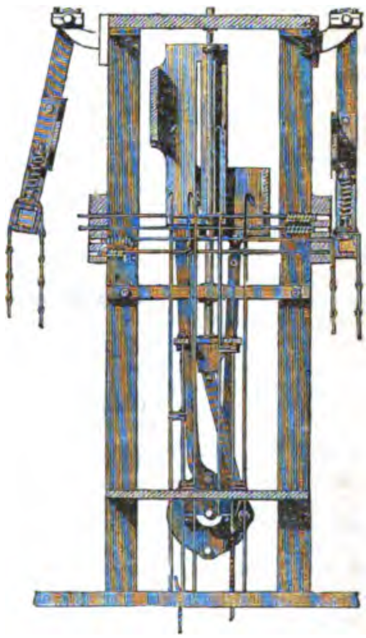
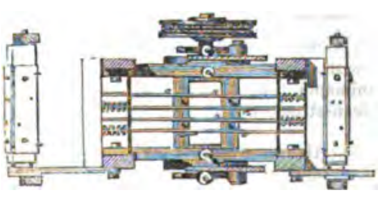


Fig. 4.



BARLOW'S PATENT IMPROVEMENTS IN THE JACQUARD LOOM.

FIFTY years have elapsed since the humble Joseph Jacquard offered to his country and the whole manufacturing world the benefit of his ingenious invention for weaving figured silk and other fabrics. Calculated though this production of his genius was to promote the interests of the manufacturer, of his day, and to alleviate the sufferings and fatigue of his workmen, a malicious short-sighted jealousy effected an opposition, which terrified the inventor, compelled him to shut up his admirable piece of mechanism, and to live in constant dread of personal destruction. All the weaving classes thought their interests would be invaded and injured by a general introduction of the improved machinery, and through a blind fatuity they discouraged, instead of fostered the efforts of the ingenious artisan.

During the last half century no great improvement has been accomplished in the jacquard loom, of which it may perhaps in truth be said, that with the exception of steam no discovery has surpassed it in utility.

Fig. 3.

How different in the present day is the disposition of the producing community! At Bradford, in Yorkshire, where competition is proverbially keen, Messrs. Bottomley, Wilkinson and Company, have recently lent all their aid in enabling Mr. Barlow, a stranger, to bring out his patented improvements of the Jacquard. The services of their workmen, the use of their mill, the application of their steam power, and other appliances, have all been most kindly afforded, and, under a liberal and enlightened view of commercial policy, assistance has been given where destruction in the last century would have been devised.

Under the existing Factory Law which limits labour to ten hours, increased production, without a corresponding increase of expense, is a matter of such direct interest to the mill-owner, that little need be said to commend a discovery which has been proved to secure so important an object, and the machine now patented is brought before the public with a conviction that it will successfully tell its own tale.

The claims made in the specification of the patent, are—

1st. For constructing a Jacquard apparatus, with double counterpoised griffs, for simultaneously raising and lowering portions of the warp.

2nd. For applying two barrels, bands, or sets of cards to the Jacquard apparatus, and

3rd. For constructing and combining hooked or suspended wires for giving motion to the harness of looms.

The first claim contemplates increased speed by means of double action; the motion being similar to that in plain weaving, one shed rising whilst the other is descending.

The second claim has reference to a facilitated action of the machine by the alternate motion of two cylinders, and

The third claim comprehends improvements for giving a double action to the loom by the construction of wires.

In all cases where increased quantity of production, without a corresponding

increase of expense, is the chief object to be secured, it is believed that this invention will be adopted, as whilst ordinary Jacquards with the application of power throw the shuttle 100 times in the minute, the patented machine enables it to traverse the warp upwards of 140 times during the same period with equal ease and safety, and the improvement is rendered peculiarly applicable to all descriptions of tender and delicate warps, in consequence of the great diminution of friction.

In proportion to the extension of production the cost of manufacturing will be reduced, and cotton goods, hitherto printed and dyed, may be woven with figures.

Fig. 1 of the accompanying engravings is a front elevation of a Jacquard machine as thus improved.

Fig. 2, another front elevation, partly in section.

Fig. 3, a sectional elevation, at right angles to fig. 1.

And fig. 4 is a sectional plan on a line above the horizontal needles.

With the help of the preceding description these figures will give the manufacturing reader a tolerably clear notion of the construction of this machine, and the important advantages which it possesses over every other form of construction.*

MATHEMATICAL PERIODICALS. BY THOMAS WILKINSON, ESQ., F.R.A.S.

(Continued from p. 455.)

XXVI. *The Yorkshire Repository.*

Origin. The first portion of this periodical, consisting of the prospectus and twelve pages of preliminary matter, was issued at York under the title of "*The Yorkshire Repository*," about the beginning of October, 1794. The Editors in their opening address declared it unnecessary "to expatiate on the importance of literary and scientific studies," since all they could "say on the subject would be but a repetition of what all know and are ready to acknowledge." They encourage the young aspirant by assuring him that there are many "who possess unknown, even to themselves, geniuses capable of following a Newton through all the intricacies of science—capable of contesting the laurel with a Pope—and rivalling an Addison in sentiment and expression, (who) are lost to the world and themselves, perhaps for want of a *stimulus* similar to that we intend laying before the public:" and since "utility will be the touchstone" by which communications will be tried, they are assured that though their attempts "be ever so humble, they will always meet with candour." The necessity for such a publication seemed imperative "at this period, when Science and Literature are falling beneath the influence of *political* declamation, and when the *violence of party* is robbing society of the charms of social conversation; (and), if to divert the mind from that which too surely fills the breast with rancour, and to direct it to objects which *humanize* the affections and give charms to sentiment be desirable, the *Repository* will not have *inferior* claims to public approbation." Yorkshire, they believed "to be a soil in which genius abounds," and which promised to the publication some able writers; and at the close of their address they remind "those *friends* of science and literature into whose hands this shall fall" that "they have claims upon them for help." "We," say they, "are exerting our strength in support of drooping science—we are beginning the contest for a spread of literary knowledge, and they (*the friends*) ought not to look idly on—to *join* us is a *duty*, and to *neglect* it is little less than a *crime*." After so many appeals, remonstrances, and assurances, one would be ready to predict long life and much usefulness to the *Yorkshire Repository;* but the Editors had indeed "built *great* gates to a small city," for it ceased to exist with the first *regular number*, about January 1, 1795. The whole work consists of 124 small octavo pages.

Editors. The title pages are wanting in the copy from which I quote, nor

* Manufacturers desirous of further information may communicate with Messrs. Brace and Colt, Solicitors, 24, Surrey-street, Strand, London.

does the body of the work offer any clue to unravel the Editorship. From the fact, however, of a portion of the Editor's address in the *Repository* being transferred *verbatim* into the preface to the first number of Leybourn's "*Mathematical Repository*," O.S., I am induced to offer the conjecture, that probably Mr. Leybourn had something to do with the management of the work.

Contents. The contents of the first portions are, "The Editor's Address;" "Subjects for the *first* department," being the titles of six Essays on "Scandal, Duelling, &c.;" for which prizes were to be awarded; "Subjects for the *second* department," consisting of Enigmas, Rebusses, Charades, and Philosophical Queries. "The *third* department" is devoted to "Mathematical Questions," and concludes by stating the principles upon which the several prizes will be distributed. The "first department" of the *regular* number contains Prize Essays "On Scandal, by C. S."; "On Duelling, by Mr. Barnard, York;" "On that Universal desire men feel of being remembered after Death, by Mr. W. J. Earthwell, York;" "On the Aurora-Borealis, from the *French* Encyclopédie;" "On Stage Entertainments, by Solwin, Sunderland;" "On Satire, by Mr. Walter Lich, York;" and a selection of six subjects for future Essays. The "second department" contains "Poetical Answers to the Enigmas, Rebusses, and Charades," by Messrs. Ayres, Cooke, Oliver, Rimmer, Reeves, &c.; new Enigmas, Rebusses, and Charades, by Messrs. Wilkinson, Oliver, Arne, &c., several of which present points of excellence not usually found in provincial periodicals of the same date. The Queries are few in number, but are answered with considerable fulness and ability:—several able discussions on "*Badging* the poor;" "St. Paul's fighting with beasts at Ephesus;" the "White Stone," mentioned in the Apocalypse; "The best method of preventing *slugs* and *flies* from destroying the seedling leaves of turnips;" are given by Messrs. Tetlow, Mountain, Erastus, Sewell, &c. The "*third* department" is occupied by the "Answers to the Mathematical Questions proposed in the Prospectus." The preceding articles form "Part I." of the regular number of the work. "Part II." containing the "History of Domestic Literature of the first six months of 1794." This department contains a series of reviews of the various publications on "Theology, Morals, Ecclesiastical History, History, Topography, Antiquities, Travels, Biography, and Heraldry;" issued during the period named, and no fewer than *sixty-five* works of all sizes are subjected to the Editorial *fiat* of approval or condemnation. Several "Miscellaneous Pieces" on "Pious Magic;" "Casting Wood in Moulds;" "Anecdote of the Rev. Dugald Lindsay;" "Rot in Sheep;" &c., are inserted at the end of the work, and in the remarks to Correspondents the Editors "return their most warm expressions of gratitude for the very able and ingenious communications they have been favoured with . . . . (and) doubt not but the matter and the arrangement thereof, here presented, will meet with general approbation." The discontinuance of the *Repository*, however, with this very number would seem to imply that the reverse was indeed the case.

Questions. Only eight mathematical questions were answered in the *Repository*, but a second set of eight were proposed for solution, which were afterwards transferred to the first number of Leybourn's *Mathematical Repository*, O. S.

Ques. 1, requires a *geometrical* demonstration that "the fluxion (differential) of $\sqrt{a+x}$ is $\dfrac{dx}{2\sqrt{a+x}}$. It was proposed by Mr. G. Robinson, Bilton, and an elegant solution is given by Mr. Colin Campbell, Kendal.

Ques. 2, by T + B requires "to find the pressure of the water against a floodgate placed perpendicularly to the horizon," its breadth and depth being given.

Ques. 3 gives the breadth and length of a floodgate, and inquires whether it will resist "the water with the greatest force possible:" Mr. Thomas Bulmer and Mr. John Farey answer the question, and decide in the negative.

Ques. 5, by Mr. John Burdon, determines "the ratio of two weights, connected by a cord going over a pulley," when the heavier descends a given distance in a given time. It is neatly answered by the proposer and "Mr. W. Adam, master of the Free School, Woburn, Beds."

Ques. 6, by Mr. Burdon is a case of the "Curve of Pursuit;" a solution from first principles is given by Mr. J. Surtees, Sunderland, and a *numerical* calculation by means of Simpson's Formula is furnished by Mr. T. H. Swale, Becca Lodge.

Ques. 7 relates to the "power of the wedge," but as might be expected, nothing more satisfactory is advanced than what may be found in Emerson's *Treatise on Mechanics*.

Ques. 8 gives the time in the morning when "the sun is opposite the south side of the large steeple in York Cathedral . . . . when the days are longest," to find the declination of the steeple and the time when "the sun will come to the same point when in the equinoctial and winter solstice." It was proposed by Mr. Thomas Crosby, York, Author of a Key to Walkingham's Arithmetic; and was neatly answered by Mr. Colin Campbell and the Rev. L. Evans, Little Bedwin. This question is one of those which Mr. Campbell has included in his elegant little work, entitled "Lucubrations in Mathematics," printed for private distribution, Liverpool, 1848.

Several of the questions left unanswered are also worthy of regard, but this will be more properly done in a notice of the *Mathematical Repository*, to which they were respectively transferred.

Contributors. Messrs. Adam, Arne, Ayres, Barnard, Boswell, Bulmer, Burdon, Campbell, Crosby, Earthwell, Erastus, Evans, Ewbank, Farey, Fletcher, Lich, Mountain, Oliver, Reeves, Rimmer, Robarts, Robinson, Rutherford, Sewell, Solwin, Surtees, Swale, Taylor, Fetlow, Thompson, Wilkinson, &c., &c., &c.

Publication. The publication took place *quarterly*, and all communications were to be "left at the *Herald Office*, York." In consequence of the absence of title pages I am unable to say who were the publishers, but from a notice to correspondents it appears the work was issued both in London and at York, and could be had of the "booksellers in the same manner as other periodical works are obtained."

THOS. WILKINSON.

Burnley, Lancashire, Dec. 11, 1850.

CALOMETER OF FUSIBLE METAL.—ARTIFICIAL FUEL.

"The heat given out by coals, when mixed with other substances, has never been tried," appeared at the head of instructions which Sir Samuel Bentham, in the year 1796, gave the chemist in his office, with a view to the investigation of this and other points relative to fuel: the same might be said even at this day, when so many mixtures for this purpose are in use. It were well that the comparative advantages of those several compositions should at last be ascertained; and doubtless the cost of the requisite experiments would be amply repaid to the manufacturer who could prove that his mixture was really more economical than coals. In those instructions, a new calometer was directed to be used, because "the porosity of half-melted iron occasioned error in Lavoisier's calometer, by holding water which does not drip away from the ice at the end of the experiment." Therefore

"A calometer for this purpose would be better of *fusible metal* than of ice, possessing all the advantages of ice in melting and running away; and by keeping it in water heated to a certain degree, its temperature, when put into the calometer, might be exactly uniform. Fusible metal has the advantage over ice of not melting in the heat of the atmosphere—the cause of considerable difficulty in the management of ice, as well as of uncertainty."

"Cylinders of the fusible metal might be put into a hollow cylinder passing through the middle of the fire."

"But would this metal become porous, like ice, when half melted?"

Sir Samuel then speaks of the practice so common in Wales and in Sweden, of mixing small coals with clay, and forming the mass into balls; the clay being first stirred in a cistern of water till it is brought to the thickness of treacle, when small coals are then stirred in till the mass is of a proper consistence to form it into balls. This economical fuel can be manufactured in a small way, and might be made a source of saving to many an industrious family in the metropolis and elsewhere.

Where this employment of small coals is practised, the general impression is that more heat is thus obtained from a given weight of small coal than from an

equal weight of large; if so, he observed, it can only arise from the favourable form of the balls in leaving hollows for the admission of a proper current of air—but this purpose might be attained by making the fuel up into cylinders of a suitable size, which would be desirable were large quantities to be manufactured, as this form could be easily given by machinery.

"Different properties of fuel are required for different purposes. Where only a temporary heat is required, such fuel as gives out its heat suddenly, and which can be extinguished without loss of heat, is the most appropriate. Where an uniform long-continued heat is desired, clay balls might be advantageous, as they long retain heat; but that which they have taken up by the burning of the coals would be so much wholly lost were they raked out of a fire-place before they had parted again with their heat."

Amongst the mixtures Sir Samuel directed to be tried, were expedients for rendering coal of bad quality inflammable, as coal-tar is now used, but he also indicated the addition of shavings, sawdust, &c. As sawdust is now in the metropolis to be had in quantity for merely an engagement to cart it away, this might probably be employed for mixture in economical fuel. So also the heaps of small coal now burnt at the mouths of many pits might be found to produce a profit on their conveyance to the metropolis, and elsewhere, to be mixed with clay and some of the herein mentioned substances.

M. S. B.

FLAX COTTON.—(SEE ANTE P. 416.)

The interest which has been evinced by the agriculturists and manufacturers of the country, with respect to the success of the proceedings connected with the adaptation of flax to existing cotton, silk, and wool machinery has sufficiently shown the importance which, in a national point of view, has been attached to this discovery. Our repeated statements as to the possibility of adapting the flax fibre to cotton and other machinery have been received with incredulity by many of our contemporaries. Notwithstanding, however, all the prophesies that "it was likely to prove an entire failure"—the statements, that from the very nature of the material it would be impossible "to produce a fine or even thread" by cotton machinery—we felt confident, from the knowledge we had obtained of the most minute particulars of the process resorted to by the inventor, that the result would fully justify every statement which we had made; and the fact which we lately announced, that a considerable quantity of yarns adapted both for "warp" and "weft" had been produced at Manchester, has, we trust, fully removed all doubt upon the question as to the practicability of the plan. The *Manchester Guardian*, which but a few days since denied "that a single ounce of yarn had been produced either in Manchester or the neighbourhood," and that "all they had heard upon the subject from parties who had seen the material, had tended to confirm their previous impression that as a substitute for cotton, the whole affair would prove an entire failure," has now admitted that yarns of "a very fair quality," and about equal to No. 30's, had been produced. The following are the remarks of our contemporary on the subject:—

"FLAX COTTON.—We have at length seen a sample of yarn spun by Messrs. John Bright and Brothers, Rochdale, from M. Claussen's prepared flax mixed with an equal weight of cotton. It seems to be about No. 30, is of very fair quality, and has apparently been spun on a throstle. Whether any attempts have been made at Rochdale to spin flax without an admixture of cotton we are not informed. If there have been any such attempts, it is to be presumed that they were unsuccessful, or we should no doubt have seen or heard of the yarn produced.

"Whether the partial success of this attempt to substitute flax for cotton will lead to any important consequences remains to be seen. No doubt, if the flax is, as alleged, considerably cheaper than cotton at the present time, and can be substituted to the extent of one-half for that material in the production of the lower numbers of yarn, which absorb by far the largest proportion of material, some considerable effect may be produced on the market when the partial failure of the crop of the United States would otherwise raise prices. At other times we imagine cotton would be found not only the more convenient but the cheaper material."

With respect to the important consequences which may follow upon this invention, it is totally unnecessary for us to speculate; but we fully agree with our contemporary in the opinion that a discovery which will have the effect of providing a substitute to the extent of one-half of the present consumption of cotton, in those yarns "which absorb by far the largest proportion of material," cannot fail to have some con-

siderable effect upon the market. With reference to the concluding portion of the above remarks of our contemporary, that at those times when there was no partial failure of the cotton crops of the United States, "cotton will be found not only the more convenient but the cheaper material," we understand that the inventor will be prepared in a few days to supply the prepared fibre at from 4d. to 6d. per pound. The inventor has announced that he is now prepared to purchase several hundred tons of flax in the straw, for the purpose of its conversion into flax cotton, and other prepared fibres. We should not feel justified in stating the exact amount of the expenses to be incurred in the preparation of the fibre; we may state, however, that one ton of flax straw will produce one-fourth of its weight of a material ready for spinning on cotton machinery, at a cost not exceeding the price at which flax straw may now be purchased.

In the preparation of the flax the process of steeping is entirely obviated, as the experiments which have been made have most satisfactorily demonstrated that the steeped fibre is totally unsuited for the process. The steeped flax has been found not to be strong enough to stand the "carding" process, and it is apt to get into a state known as "overworked," preventing the possibility of obtaining a fine or even thread in spinning. There is also the greatest possible uncertainty in dealing with the steeped fibre, in consequence of the inequality of strength which it possesses. The inventor, therefore, proposes to purshase the flax either in the straw or prepared upon the unsteeped process.

The Committee of the Royal Flax Society (of Ireland), who gave it as its deliberate opinion that the fibre prepared upon the unsteeped process was "coarse, harsh, and wiry, and fitted only for the manufacture of sail-cloths, tarpaulins, ropes, &c," will, no doubt, be surprised to hear this statement. The fact, however, is one to which we have throughout given considerable prominence in our notices of this invention, inasmuch as it affords to the flax-grower an opportunity of either disposing of his flax in the straw, or of preparing it himself, without being compelled to go through the tedious, expressive, and semi-chemical processes of steeping his flax. It is mainly upon the removal of this obnoxious process, and the substitution in its stead of a cheap, simple, and efficient mode of preparing the flax, together with the opening up of new and extensive markets for the material so prepared, at such a price as will prove alike beneficial to the grower and the labourer, that we rely upon seeing such an extension of the growth of flax throughout the country, as the ten years of unremitting exertions "of the Royal Flax Society," backed by grants from the public funds, and an influential body of spinners, have hitherto completely and signally failed in bringing about.

The material which the inventor has produced, and has succeeded in spinning up to the present time, will be known as "flax cotton," "flax fibre," "flax wool," and "flax silk." The first of those materials—"flax cotton," consists of a mixture of flax and cotton carded together, and is similar to that to which our contemporary alludes as being of a "very fair quality," and equal to No. 30's cotton. Although only equal to No. 30's, it may be spun to almost any degree of fineness at which cotton is ordinarily spun. The "flax fibre" consists of the pure flax, without any admixture of cotton; and several "cops" of the yarn spun from the rovings made at Bolton have been forwarded to us. The third material prepared by M. Claussen is what he terms "flax wool," which consists of a combination of flax and wool carded together in such a manner as to admit of the material being spun and woven upon existing woollen machinery. We have lying before us at this moment several specimens of cloths and flannels manufactured from this substance; and we understand that a contract has been taken to supply a considerable quantity of the "flax wool" cloth as clothing for the army. This material is capable of being carded and spun together, in the proportion of one-third wool and two-thirds flax; but with half wool and half flax, it is almost impossible for the most experienced person to detect the mixture. For durability, we understand that this mixture exceeds that of fabrics made entirely from wool. The reductions in the price of woollen cloths, which must follow upon the adoption of the invention in the clothing districts, are too obvious to need comment. The "flax silk" is also a combination of two fibres consisting of flax and short silk carded together, and, like the other mixtures, capable of being spun upon the existing silk machinery. The flax fibre may also, we believe, be prepared so as to spin with long silk, and some specimens which we have seen woven from each kind of material are exactly similar in appearance to those formed wholly from silk.

We have thus stated the results which have been obtained up to the present time; and it is a source of congratulation to us to find that those who had expressed their incredulity as to the accomplishment of these results should have at length been

satisfied that there is really something in the affair.

* * * *

In order to meet any objection which may yet be urged by persons who still doubt the value of the invention, as to whether the fibre thus prepared will be adapted for weaving, it is proposed, as soon as a sufficient quantity of yarn has been spun, to weave it into cloth. The process of bleaching intended to be adopted is one of the most beautiful, and at the same time the simplest operations of chemistry that we have ever witnessed. Of all the ingredients at present employed in the bleaching process scarcely one is employed, and those which are used have no deteriorating effect whatever upon the material. The period required for the operation of bleaching, instead of being reckoned by days, will be calculated by minutes. There is no doubt but that such a statement as this will be received with considerable incredulity by many persons, and a very considerable number of the failures of past ages will, as was the case with the spinning of the flax fibre, be resuscitated for the purpose of proving the impossibility of reforming or amending the present system of bleaching. We trust, however, that the result of the experiments which we have already announced will convey the lesson that the "impossible" is a term which, in the present advanced state of science, ought to be cautiously used in dealing with subjects which at first sight may appear startling and even impracticable.

The value of the invention is intended to be tested in every stage. The material having been bleached, the fabric woven from it will be tested as to its strength with the ordinary cotton fabrics of a similar weight and number; and in order to satisfy those persons who might still object that although the fibre had been produced, spun, woven, and tested, still that it would not receive the dye, or be capable of being printed, experiments will be made for the purpose of setting these points at rest. These experiments having been concluded, a report will be duly made by those manufacturers under whose inspection the experiments are carried on, which will, we have not the slightest doubt, fully confirm every statement we have made, and every opinion we have expressed with respect to the merits of this important invention. Those who are conversant with the details of the cotton manufacture, may be able to form some opinion of the difficulties which have had to be overcome by the inventor, in adapting a totally new material to existing mechanism, from the amount of delay and trouble necessarily incurred in adapting even a different staple of cotton to the machinery. The various points of detail with respect to the length of fibre which could be spun, and numerous other points which will suggest themselves to every person in the least degree acquainted with the subject, had each to be worked out and tested by the inventor, and it is a matter of surprise that in so short a space of time results so satisfactory should have been obtained.—*Morning Chronicle.*

GUTTA PERCHA COVERING FOR ELECTRIC WIRES.

Sir,—Observing in your Journal the Report of the American Patent Office relative to telegraphs, we feel desirous of drawing your attention to the inclosed letter from Edward Highton, Esq., from which you will perceive that after a test of not less than *a year and a half*, he gives a most favourable report of the gutta percha covered wires.

The imperfect manufacture of the material in America is probably the cause of failure there. We are, Gentlemen,

Yours very truly,

THE GUTTA PERCHA COMPANY.

Gutta Percha Company, Wharf-road, City-road, London, Dec. 6, 1850.

Letter from Mr Highton.

Gentlemen,—In reply to yours of the 20th instant, more than forty miles of your gutta percha covered wire for electro-telegraphic purposes, have been laid down on the London and North Western Railway, under my superintendence as Telegraphic Engineer to the Company. Of this quantity, about fifteen miles have been placed underground.

A portion of the wire has now been in constant use for nearly a year and a half. Up to this period I have every reason to be satisfied with the results of the action of the gutta percha covering.

I have also had, for experimental purposes, some of your gutta percha covered wire, laid in the German Ocean. It has now been submerged in the sea for *more than a year*.

Where the wire is placed, marine insects eat away and completely destroy pine timber of great thickness in less than seven years. The gutta percha covering to the wire, however, remains *intact*, although a portion of it is fastened to timber, which, owing to the ravages of these insects, has already been renewed. Up to this period, I have every reason to be satisfied with the results of this experiment with gutta percha covered wires submerged in the sea.

I am, Gentlemen, yours obediently,

EDWARD HIGHTON.

British Electric Telegraph Company, London, Sep. 23, 1850.

THE PRUSSIAN RIFLE, WITH AMERICAN IMPROVEMENTS.

Dr. Rand exhibited at the Franklin Institute (19th September), the Prussian Rifle, as improved by Mr. John Würfflein, jun., of the firm of Würfflein and Psotta, gunsmiths, of Philadelphia. This gun is celebrated as having been used with great effect against the Danes in the Schleswig-Holstein war, and is remarkable for its long range. The principle of the weapon, which loads at the breech, is that of lighting the powder of the charge at the upper portion, so that it ignites backwards. This is effected by placing the percussion powder in the cartridge next the ball; this percussion powder is ignited by means of a needle, which, when the trigger is pulled, starts from the breech of the gun, traverses the axis of the cartridge, and explodes the percussion powder, and consequently the whole charge from before backwards. The mechanism of the lock is, as improved by Mr. W., highly ingenious, while at the same time it is more simple than an ordinary gun lock. It is provided with a safety apparatus, which renders an accidental discharge of the piece almost impossible. But few experiments have as yet been made with this rifle in this country; at one trial it was found, at a point blank shot of 150 yards, to drive the ball through a 4-inch cedar plank; its maximum range has not been yet ascertained.

Dr. Rand also presented a very light short rifle, made by the same firm, which is characterised by having projecting into the barrel, in its axis, from the breech, a short stiff iron pin, a little over an inch long; the ball rests on this pin when driven home. By this arrangement the lead of the ball is forced into the rifles without the grains of the gunpowder being crushed. This rifle, at a distance of 350 yards, with an elevation of a quarter of an inch, drove its ball through a pine plank an inch thick. It is so light that it might be fired with one hand.

SUBSTITUTE FOR THE MARINE GLUE.

An excellent transparent substance, well adapted to replace the marine glue of Jeffreys for many purposes, particularly where a transparent joint is required, as in the union of pieces of glass, invented by Mr. S. Lenher, of Philadelphia, was exhibited at the monthly Meeting of the Franklin Institute (September 8, 1850), and its properties explained. From its transparency, it was suggested by the Chairman, Mr. G. W. Smith, as admirably adapted for the union of the parts of polyzonal lenses and rings. Small glass boxes, for containing microscopic objects, united by it, were shown, and gave much satisfaction. The composition of the cement is as follows:—Caoutchouc 15 grains, chloroform 2 ounces, mastic half an ounce. The two first-named ingredients are to be first mixed; after the gum is dissolved the mastic is added, and the whole allowed to macerate for a week, which is about the time required for the solution of the mastic in the cold. More of the caoutchouc may be added where great elasticity is desirable. The convenience of its application with a brush, cold, recommends it for approval.—*Franklin Journal.*

THE RESISTANCE OF WATER TO MOVING BODIES.

Sir,—It is occasionally stated in modern scientific works, that the velocities of a vessel moving through the water are proportional to the cube roots of the different powers employed to propel it at different velocities, and that this has been deduced by mathematicians, from the well-known rule, obtained from experiment, that the resistances are proportional to the squares of the velocities. A solution of this from any of your mathematical correspondents, or a reference to any book where it may be found, would confer a favour on a practical man, and it would be all the more acceptable to his class, if it can be done without the differential calculus. A. B. C.

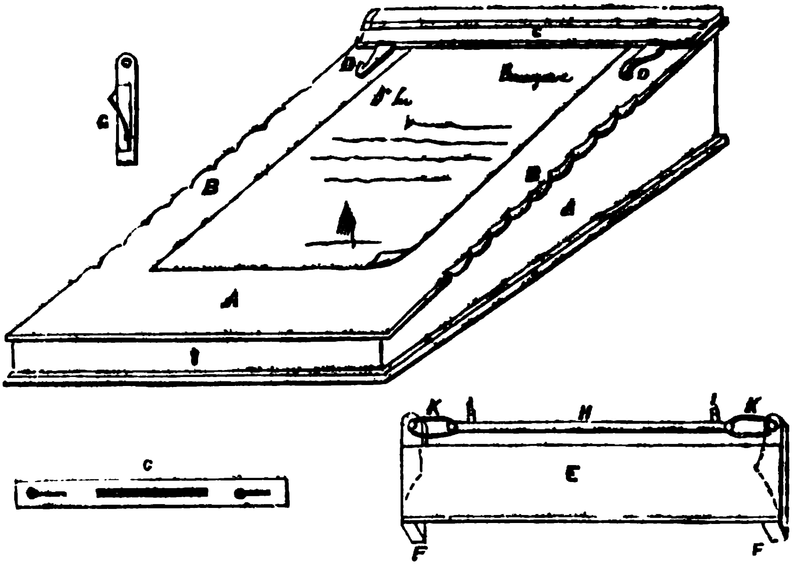
AMERICAN PATENT CASE.

After a long and tedious trial, the famous lead-pipe case terminated on the 21st of November. The suit was for the recovery of damages for the alleged infringement of a patent to Mr. Benjamin Tatham in 1841, for an improvement in machinery for making lead-pipe; Samuel G. Cornell and Co., being the alleged infringers. The defence was that Messrs. Cornell and Co. did not use Tatham's improvements, but a different combination, also secured by patent to Mr. Cornell in 1847.

The Court (Judge Nelson,) said if the jury believed that the defendants used the same combination, substantially, that was found in plaintiff's patent, they infringed his patent—but if the changes were substantially different, then they did not infringe; also, that if the changes in the mechanical construction of the machine made by defendants were apparently of a similar form, yet if they produced a new and useful effect, different from that of plaintiff, in the manufacture, then they did not infringe.

The jury returned a verdict that plaintiffs were the original inventors of the machine patented by them—and that the patent had been infringed by defendants. They found damages in favour of plaintiffs for 2,245 dollars.—*Scientific American.*

WRITING DESK FOR THE BLIND.



Sir,—Will you do me the favour to insert in your valuable journal the accompanying sketches, and description of a desk, which I constructed in June last, for the use of a gentleman in London, who has for eight years been deprived of his sight. I have deferred sending them to you until I had had his opinion upon it. After having used the desk nearly six months, he has given his most unqualified approbation. As I know him to be a practical man as well as a sculptor of eminence, I do not hesitate to recommend its adoption by the various Institutions for the Blind, and as I am desirous that the benefit shall be extensive, I have not secured the invention, but shall be very happy to give working drawings to any Institution that may request them. I shall forward, shortly, a desk complete, to the "London Polytechnic Institution," where it may be inspected.

A is the desk of the ordinary description; a board with, or without a support at the back, will answer the purpose where cheapness is an object. BB, are indentations in the edges of the lid, which render it ornamental, rather than otherwise, each side corresponding half an inch apart, or nearer if preferred. C is a bead across the top, sliding backwards and forwards on a slight incline, to admit, and hold the paper tight; against a small ledge glued on the lid, inside the slide, the paper abuts, preventing it going beyond a proper distance. DD, are guides, that the person may feel when the paper is in the centre. E is a board of $\frac{1}{16}$ or $\frac{1}{8}$th of an inch wood, on which the hand rests, when writing, and which keeps the paper flat and free from creases, on each side; underneath are glued guide-pieces, FF, in which are steel springs, bent into the form represented in the sketch, G; these springs take into the notches on each side the lid, and yield to an easy pressure when it is necessary to draw the back-board down a line. H, is a bar of plated or brass wire, about No. 11 gauge. I, I, are stops, which the pencil touches in beginning and ending each line. KK, are India rubber bands, attached to the guide-pieces (the ends of which project half an inch); these bands keep the rod, or bar H sufficiently steady when writing, and yield to a gentle pressure for the letters which run below the line.

This desk or board may be found useful to the working classes, who complain very much of their incapability of writing *straight*. Trusting it may be found

beneficial to those for whom it is intended,

I am, Sir, your obedient Servant,

WILLIAM MORGAN.

Bromsgrove, December 12, 1850.

PILE-DRIVING BY ATMOSPHERIC PRESSURE. DR. POTTS'S SYSTEM.

Immediately after the enrolment of the late ingenious Dr. Potts's specification of his patented system of pile-driving by atmospheric pressure, we published the first complete account of it given to the public, and expressed at the same time also our perfect conviction of its efficiency. (See vol. xiv., p. 68.) The system has since come into extensive use; and has in practice fully confirmed the high expectations we had formed of it.

In a paper on Lighthouses and Beacons, by Mr. G. A. Findlay, published in the last Part of the Transactions of the Society of Arts, there is the following notice of some of the earlier applications of this system:

This beautiful adaptation of atmospheric pressure has been applied to the erection of several beacons in the vicinity of the mouth of the Thames. The first experiment was upon the Goodwin Sands, on July 16, 1845, and an iron tube of 2 feet 6 inches diameter was driven into the sand to a depth of 22 feet, in two or three hours. A gentleman, present at the experiment, which was made by the Trinity Brethren, said, that the facility with which this large iron tube was made to descend could be compared to nothing better than shutting up a telescope. The method of operation is this; the tubes are in convenient lengths, with spigot-and-faucet joints, and one of them being placed perpendicularly, an air-tight cap is fixed to the upper end. This cap communicates with a powerful air-pump, by means of which the air is exhausted from the tube, drawing up the sand or shingle with the water which ascends, and the tube immediately descends from the effects of outward atmospheric pressure. The contents of the tube are then removed by the pump, which readily draws away the sand or shingle with the water which rises during their action, and the exhaustion process is then continued. The upper end of the tube having become level with the surface, the operation is stopped, the cap removed, a fresh tube is affixed and secured, and the same course pursued, and thus continued, until, with the greatest facility, this great length of tube penetrated what must have been exceedingly hard sand, nearly resembling stone; as was found by Mr. Bush in his erection of a caisson on these sands, as hereafter described.

The practicability of the scheme being proved, several beacons, as before stated, were erected—as on the Buxey, the Shingles, the Girdler, the Margate, and other sands lying in the mouth of the Thames. And in order to test its capabilities on a large scale, a beacon was constructed on the South Calliper of the Goodwin sands. It consisted of five cast-iron tubular columns, the centre one, like that above described, 2 feet 6 inches diameter, and penetrating the sand to the depth of 31 feet 6 inches; four smaller tubes surrounded it, and were connected diagonally and laterally, by means of wrought iron rods and clips, secured by screws and wedges. The centre column rose 37½ feet above the sand, and was surmounted by a staff and cage, which was 18½ feet above the cap of the centre column. Such was the structure which, on August 26, 1847, was announced to mariners, and which promised so much for stability and to prove beneficial in its application to the general purposes of navigation. But during a severe gale on October 23, following, this beacon disappeared. It was seen perfect a few hours before its destruction, and now not a vestige even of its foundation is discernible. The failure in this instance, however, was no conclusive proof of the correctness or impracticability of erecting a Lighthouse on such a foundation. When the great force of the waves is recollected, and the large surface that was offered to them, compared with that of Mr. Mitchell's pile Lighthouse at Morecambe Bay, it is not surprising that the one should have proved more permanent than the other. The exposed site of the South Calliper Beacon was certainly well adapted to test its stability, before applying it to the purposes of a Lighthouse; and the result has proved that such would be a hazardous experiment in such a place.

Mr. Joseph Cubitt has since adopted this plan with perfect success in the construction of several bridges on the Great Northern Railway; as has also Mr. Locke in building the bridge over the Thames at Windsor, for the Windsor and Staines Railway; and it is now being followed by Mr. William Cubitt in the construction of the new bridge over the Medway at Rochester, and by Mr. Hemans in the building of another over the Shannon. We extract the following particulars respect-

ing these structures, and Dr. Potts's system generally, from the Minutes of Evidence taken before the Select Committee of the House of Commons on the Westminster Bridge (July 9, 1850).

W. Cubitt, Esq., C.E., M.P., examined —What dimensions of cylinders are you now using at the Rochester Bridge?—The cylinders are 7 feet in diameter, and in this case I should probably put down cylinders of 10 feet in diameter, so as to make the diameter of one cylinder form the width of one pier, so that a row of these very large cylinders sunk, to 10, 20, 30, or 40 feet, would make a most durable and excellent foundation, and require no coffer-damming at all.

Will you explain the mode of operation by which you drive down, or procure such enormous pressure as to force those large caissons or piles into the earth?—The piles would be in this case, I should say, probably 10 feet in diameter, consisting of hard thick metal hollow cylinders, the bottom edges being quite sharp, and they are in lengths of 9 or 10 feet, turned up upon the lathe so as to go together perfectly air and water-tight, and bolted together one upon another as they go down. The mode of driving them is to have a tight cap of the same diameter on the top of the cylinder similar to the top of a steam-engine cylinder, and when the cylinder is fixed to drive it through the water and through the guides to the bottom perfectly perpendicular. The air is exhausted from the inside of the cylinder entirely, and the pressure of the air as you let on the pressure of the atmosphere drives it down. The pressure of the atmosphere upon a 10-feet cylinder would be equal to a column of water about 25 feet high, which is a great many tons.

You fill in those cylinders with masonry, do you not?—Yes, with solid brickwork.

Can you conceive any more secure mode of laying a foundation than this plan presents?—I do not know a better. It is exceedingly good, as we have the means of driving them down; and we can do it by two methods, both of which my son has used, both at Huntingdon and at Peterborough. The Huntingdon Bridge is built upon round piles; circular cylinders, one row forming a foundation in the river for one pier, and another row forming a foundation for another pier, making two piers, and the bridge is at work as a railway bridge. At Peterborough they are now completing another bridge in a more difficult situation, and not so good a foundation as the Huntingdon one, and my son proposed, instead of putting down circular cylinders, which did not fill up the whole space of the pier, to make square cylinders, 6 feet square, and drive them close together, so that they have a large 6-feet cylinder sent down to the bottom, filled with brickwork, which makes a solid brick pier, encased in cast iron.

Chairman You would not in that case use the word cylinder?—No; this is a hollow prism; we have no term for the hollow square.

Sir *C. Burrell*. Would the square cylinders be as strong as the circular ones?—Quite. They are quite as strong, because they are filled with brickwork; they are strong enough to resist the pressure of the atmosphere when there is a vacuum inside them.

How do you fill them?—By going down into them by a ladder.

Mr. *Peto*. This mode of construction would admit of making the base of the piers any size that you might require, would it not?—Yes, whatever you pleased.

It also presents this advantage, the piles being once driven, that it would not be necessary to disturb the earth by withdrawing the piles with a dam around them?—Nothing of the kind. At Rochester I should state that I am making piers—there being a heavy tide there, and subject to a great rise and fall—with two rows to each pier, two rows of 7-feet piles, and in this case I think one row of 10-feet piles would be ample, or two rows of six feet.

Will you state to the Committee what saving you suppose you effect at Rochester Bridge by this mode of construction over the old mode of coffer-damming?—I have a contract going on for making two piers and two abutments, for as small, indeed I think a smaller, amount of money than it would cost to make coffer-dams in the same place.

In what proportion is the amount less?—Perhaps 2,000*l.* or 3,000*l.* less; the whole contract for the foundations and filling th up will not exceed 25,000*l.* in that large deep river; coffer-dams for the same work would have cost a great deal more than that.

When you say 3,000*l.* or 4,000*l.* more, do you mean for each?—The coffer-dams for the work to build the bridge in the usual way would have cost several thousands more than the whole work costs according to this plan.

Mr. *Peto*. Do you mean that the cost of the abutments and piers, completely and perfectly executed, will be less at Rochester Bridge by 3,000*l.* in the aggregate than the coffer-dams would have cost?—Yes; and I think a larger sum than that difference in a tideway like that, where the old bridge formerly stood. Driving coffer-dams is a very difficult business, without reckoning the con-

stant expense of pumping them out for months or years during the execution of the work. And what I would strongly press upon the attention of the Committee is, that the two bridges, the one at Huntingdon, over the Ouse, which is finished and at work, and the other at Peterborough, and immediately going to work, over the Nene, are both built; and the last one, at Peterborough, was built under very difficult circumstances, for when they were driving the first, after having bored the ground, they found it pretty well under the first square tube for the foundations, and they worked till they could go no further; it was not deep enough by several feet; they then pumped out the water and excavated the earth from the inside, and they went down and examined, and they found a stone-floor at the bottom of hard rock, which was some 3 feet and upwards in thickness. Now there the making of a coffer-dam would have been very difficult. They then bored a hole through the stone and tried how thick it was, and afterwards quarried out the stone in the inside; and they made a square hole, rather more than six feet square, and then rove the square 6-feet pile through it till they got to the proper depth, and they then filled it full of brickwork; then another was driven alongside of it, and another close alongside that, till they had made a pier of 40 feet long and 6 feet thick; and there was not a coffer-dam used.

How long do you anticipate the erection of Rochester Bridge will take?—I suppose, being a heavy tideway, from about eighteen months to two years.

Charles Fox, Esq. (of the firm of Fox, Henderson, and Co.) examined.—Will you describe to the Committee the mode of construction?—Perhaps the simplest mode of describing it is to say, that instead of using the old-fashioned wooden coffer-dam, which was always a temporary work, we make use of cylinders of iron, which are in themselves coffer-dams, and which remain permanently as a portion of the structure. We adopt various modes of getting them down, but the more general one is this: we have a large receiver of wrought iron, very much like a cylindrical high-pressure boiler, and from that receiver we exhaust the atmosphere, and when we get the cylinder put into its place, just carefully lowered down on to the bed of the river, surrounded by temporary frames of timber, so as to be sure that it shall be kept in a vertical position, we put a cap on to the top, having an elastic pipe from the top cap to the exhausted receiver, and we, at the proper time, open the communication between the two, and the pressure of the atmosphere on the surface of the water in the river produces such a rush to fill up the tube, so as to get rid of any vacuous space, that it carries on a constant state of excavation under the bottom edge of the cylinder, from the pressure of the atmosphere on the top. The atmosphere takes care to push down the pile, aided by its own weight, so as to take up any little space that may have been excavated. When this mode was first spoken of, it was treated with a great deal of ridicule, and people naturally said, "Why, if the pressure of the atmosphere will push the pile down, when the pile is down it will not carry more than a weight equivalent to the pressure of the atmosphere;" and a very practical man raised that objection; not a very scientific man, but a man of very great experience; and I said to him, "Now you are quite wrong, for the principle is, that it acts as a sort of excavating process; it is quite true that the pressure of the atmosphere on the top is useful, as it gets over any little friction on the sides of the tube, so as to enable it to follow into the excavated space, and without that principle we could not push the cylinder down at all." To prove this, we took a 6-feet cylinder, and calculated what the pressure of the atmosphere upon that cylinder would be, and taking the whole pressure of the atmosphere, it amounted to about 30 tons. I had 30 tons of iron rails placed on the top of the cylinder, and the only result was, that it pushed it down about three-quarters of an inch into the gravel, and brought it to a bearing; but it did no more.

Chairman.—Was that upon a cylinder of 6 feet in diameter?—Yes; we then took off the 30 tons of iron rails and put on the cap and opened the communication with the exhausted receiver, and the cylinder immediately descended into the solid gravel 6 feet 6 inches by one impulse.

Having descended only three-quarters of an inch before?—Only three-quarters of an inch; it just pressed it a little into the ground with the dead pressure of 30 tons. We then removed the cap, and put on the top of the pile 100 tons of rails; but we could get no depression, except some three quarters of an inch, which was done by the little compression that you would have from the weight of the edge of the cylinder on the gravel. That is the general mode of sinking these cast-iron cylinders. But as it will be obvious to the Committee, in the event of our meeting with, say, the trunk of an old tree, or a very large stone, we could not proceed any further, and we have had to devise many means of getting over any difficulty of that kind. In the case of the bridge at the Nene, we have had to go

through not only a layer or two of gravel, but through 2 feet 6 inches of solid rock, and that rock not lying in a horizontal position, has offered difficulties which, under other circumstances, would be very expensive to overcome. To enable us to go through any unforeseen matter, it is necessary to get into the cylinder and excavate any material that may be within it, and cut through the obstruction; and to do that we have devised a means by which we convert the cylinder virtually into a diving-bell; that is to say, we fix a cap on the top of the cylinder, and the air-pumps are constructed so that they are, when required, compressing pumps, and we can pump just enough air into the cylinder to make it counterbalance the pressure of the column of water without, by which means we keep the work perfectly dry, and the men can get at it just as well as if they were working in this room.

What is the greatest depth to which you have driven a single cylinder?—I think the greatest depth to which we have driven a single cylinder is about 19 feet; but one has been driven in the Goodwin Sands 65 feet, by the same process.

The Committee understand that the cylinders are not single, but are piled one upon each other to the required depth?—Exactly so; they are generally used in 9-feet lengths; the piles for the bridge at Rochester are of two diameters, they are 6 feet and 7 feet, and they are cast in lengths of 9 feet, with flanges at the top and bottom, which are accurately turned and fitted together, so that they drop on to one another; there is a projection.

The external water will be found to be effectually excluded by such a mode of junction?—Perfectly; we never have a drop through them; they require nothing more than a single coat of paint, and when we use one of the castings we clean the flange carefully and give it one coat of good red lead paint, and put another down upon it, which is prepared in the same way; they never leak a drop.

Do you recommend as a general principle the adoption of a cylinder or of a square form?—Generally a cylinder, for several reasons.

Will you state the reasons?—In the first place, because it is the cheapest form to construct in the preparation of the casting itself; and in the second place, because it is better capable of bearing pressure, and therefore can be cast with a much less quantity of material in it; the object in a foundation being to get the largest bearing surface at the least possible cost; in the third place, because we have found in practice that it is difficult to sink square caissons close together, because, having a very small space between them, one having been sunk, it is very apt to make it difficult to sink an adjoining one; we have no ground between them to work upon.

The Committee understand likewise that there is round each cylinder a girdle of timber, which is necessary in order to keep the cylinder in its perpendicular position?—Yes; I have made use of piles upon which temporary frames are fixed, and put two rows of what we call wallings, forming a square space, in which the cylindrical pile is placed and driven by means of the pressure on the cap of the cylinder.

Are the Committee to understand that the surface, or the bed of the river, is in the first instance level in order to receive the cylinder?—Not at all; we deal with it as we find it.

You use no mechanical means, except in the experiment to which you have adverted, of 30 tons and 100 tons of actual weight; you have recourse rather to physical means of exhausting the air and admitting the pressure of the atmosphere?—Yes, because it is so much cheaper. It is a serious job to put 30 tons on to a pile, whereas a simple cast-iron cap, as I have before described, put on to the top, is so exceedingly easy.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING DECEMBER 26, 1850.

WILLIAM EDWARD NEWTON, of Chancery-lane, civil engineer. *For certain improvements in the construction of railways.* (A communication.) Patent dated June 12, 1850.

Claims.—1. A peculiar form and construction of cast-iron sleeper or bearing-plate; (peculiar only in so far as regards the arrangement of feathers or strengthening pieces, and the casting of each sleeper independent of the opposite one)—having a chair cast upon it, one jaw of which is divided into two parts to allow of the two rails being held and fastened thereto in a more secure and effectual manner than by the ordinary methods, so that in the event of one rail requiring to be removed, this operation may be effected without interfering with the other. This mode of construction is claimed, whether it be applied to bearing plates of the form above mentioned, or to those of the ordinary description.

2. Connecting opposite bearing plates together by means of transverse bars or tie rods, the ends of which, by taking into holes or sockets formed in the sleepers, securely hold the same together, without the aid of any other fastenings.

Charles Lamport, of Workington, Cumberland, ship-builder. *For certain improvements in machinery or apparatus for lifting and moving weights, working chains, and pumping, which improvements are more especially adapted to ships' use.* Patent dated June 19, 1850.

The first part of this invention relates to the application to winch and other barrels, of an apparatus for working chain cables, termed a "gipsey," which consists simply of a pulley having four or more pairs of snugs or projections cast upon the opposite sides of its circumference. Each pair of snugs receives every alternate link of the chain edgeways, and the spaces between them, which receive the links on their flat side, correspond in length with a single link of the chain. Several arrangements are also described for rendering winches applicable for the purposes of pumping.

With relation to these several arrangements, the patentee observes that he makes no claim to the gipsey winch alone, nor to the union of pumps with the ordinary winch alone; but what he considers to be new and original, and consequently desires to secure, is the combination of the gipsey winch with the ordinary winch barrel, the union of pumping apparatus with them, and also the accelerated velocity imparted to the fly-wheel, as united both with the winch alone for pumping purposes, and also with the winch and gipsey.

The second part of the specification has reference to an improved construction of block, the advantage derivable from which is, the diminution of the friction of the sheave stud in the bearings of the block—the arrangement of parts being such that when pressure is applied to a rope passing over the sheave, the latter revolves, and the boss thereof bearing on flanges formed on the shell, causes it also to rotate and act as the friction roller to the sheave. The claim, under this portion of the invention, is for making the shell of the block the friction roller of the sheave.

Ethan Baldwin, of Philadelphia, Pensylvania, United States of America. *For a new and useful method of generating and applying steam in propelling vessels, locomotives, and stationary machinery.* Patent dated June 19, 1850.

Claims (With reference to an improved construction of boiler)—1. The making it at the extremities of the shape of a frustum of a cone; 2. Filling the waist with tubes; 3. Graduating these tubes in length and diameter to that point which gives them the greatest practical efficiency; 4. Strengthening the boiler by stay-bolts passing alternately through its centre from the lower to the upper plate; 5. An apparatus for condensing; 6. A double force pump, with hanging valves; 7. The combination of the whole of these several parts; viz., the boiler, condenser, and double-force pumps, substantially as described.

2. A new mechanical combination of parts constituting a rotary engine of an entirely new description; also the several parts thereof, in combination with the respective parts of the boiler previously claimed.

3. A new propeller, termed the "Helical Plane Submerged Propeller," constituting a piece of mechanism entirely different both in principle and construction from all others known; also the method of gearing the same, both as regards—1. The disposition of a set of pulleys, with their band or strap and tightening roller at each end of the engine shaft; and 2. The use of bands or straps consisting either of two or more strips of leather or gutta percha sewed and riveted together, or a single strip of gutta percha. Also the combination of this improved propeller and gearing with the rotary engine and its appendages, and the boiler and apparatus connected therewith.

(This specification is executed not by the patentee himself, but by another party acting for him under a special power of attorney. The proviso of the patent, which expressly stipulates that the description of the invention is to be enrolled by an instrument in writing under the hand and seal of the patentee himself, has not in this case been complied with; and Mr. Baldwin's exclusive right and privilege is therefore at an end. Moreover, the description of his invention having been made public, cannot again become the subject of a valid patent.)

Robert Weare, of Angel-court, Throgmorton-street, clock and watchmaker. *For certain improvements in the means and apparatus for extinguishing fire, and in galvanic batteries.* Patent dated June 19, 1850.

1. Mr. Weare proposes to generate carbonic acid gas to be employed for extinguishing fire on board ships and other vessels, by introducing into a suitable vessel, previously supplied with muriatic acid, sufficient quantities of whiting, chalk, or other suitable carbonaceous substances, mixed to the consistence of cream, with water, or water saturated with chloride of calcium, as being less liable to freeze in exposed situations. The ship is to be provided with hose or pipes, properly arranged, and supplied with taps at intervals, through which the gas is to be conducted and applied when and where required. It is further proposed, to charge with this gas the hold of vessels carrying combustible cargoes,

previous to their leaving port, and also the magazine of any vessel in which a fire may have broken out.*

2. The residue left after the gas has been evolved is chloride of calcium, which, when purified and crystallized, may be employed in preparing calcium batteries. In these the positive and negative plates are connected together in couples, and rest on blocks of wood at each end of the box, of about half an inch thick. The space thus left is filled with crystallized calcium, and the interstices between the plates with calcium and sand, felt, cork-cuttings, or other porous material, previously washed in distilled water. The tendency of the calcium to absorb the moisture of the air keeps up the constant action of the battery. The plates are preferred to be formed of card board or thick paper, on which copper has been deposited by the electrotyping process, and which consequently have an uneven or granulated surface.

The last part of this specification refers to the construction of dry pile batteries. Mr. Weare now proposes to substitute for the glass tubes, employed by him as described in the specification of a previous patent of his, tubes of gutta percha. He takes paper, prepared by having one side rubbed with plumbago; on the metallized side he then places the metallic surface of another sheet of paper covered with copper or other metal capable of exciting galvanic action; upon that again two sheets of unprepared paper, and so on alternately. The pile is then placed in a punching machine, where discs are stamped out and introduced into the gutta percha tube, which will be ready for use when its ends are closed. The tubes may be attached together in short lengths, or the batteries may be formed in one unbroken and continuous length.

Claims—1. The mode of extinguishing fire in ships and other vessels, together with the apparatus described.

2. The application of this apparatus, or any other analogous thereto, to warehouses, public buildings, and dwelling-houses, by which a fire may in most cases be put out when first discovered.

3. The construction of calcium and dry pile batteries as described.

BENJAMIN CHEVERTON, of Camden-street, Camden-town, Middlesex, artist. *For methods of imitating ivory and bone.* Patent dated June 19, 1850.

When it is desired to produce imitation ivory, an article of beauty or utility of the desired form, must first be made from solid alabaster, gypsum, or any other native sulphate of lime. For imitation bone, the same material is employed; but it is reduced to powder, and pressed into suitable moulds in a dry state. The subsequent process is in either case the same. The article so moulded or formed is placed in an iron oven, and kept there for forty-eight hours, the heat being gradually raised from 250° to 350° Fahr. The water naturally contained in such substances is thus expelled, and the articles are rendered opaque, hard, and very brittle. They are then immersed until the surface becomes saturated, in white hard varnish, olive oil, or any other suitable fatty or waxy matter, in a melted state. This stage of the process imparts translucency, and renders the material capable of taking a polish. The last part of the process consists in immersing the articles in warm water, if the natural colour of the ivory is desired to be retained, but in water impregnated with any suitable dye, or mordant if the articles are to be coloured. After undergoing several immersions, the different articles thus manufactured may be placed in a lathe and polished with whiting or putty-powder, as customary.

Mr. Cheverton does not claim alone or together the use of heat to expel from alabaster, gypsum, or any other native sulphate of lime—the water which forms one of their constituent parts—or the use of water or dye to harden and colour them after such evaporation; but what he considers to be new and desires to secure is the employment of the varnish, commonly known as white hard varnish, or ordinary olive oil, or any other oleaginous fatty or waxy matter, in a melted or fluid state, in conjunction with the other two stages of his process, whereby the transparency or translucency above stated may be obtained.

ROBERT HEATH, of Manchester, iron merchant, and RICHARD HANDLEY THOMAS, of Woolstanton, Stafford, engineer. *For certain improvements in the manufacture of iron.* Patent dated June 19, 1850.

Claim.—The use of revolving cylindrical surfaces or rollers, moving in the same direction, but at different rates of speed, for the purpose of converting a puddled ball of iron into a bloom.

The peculiar motion given to the rollers causes the metal to revolve round its own centre, whilst at the same time it is gradually carried downwards and discharged at the bottom of the machine. The scales of metal which fall during the operation pass through a grating into a suitable receptacle underneath, and can be removed in the ordinary manner.

ISAAC HARTAS, of Wrelton Hall, Yorkshire, farmer. *For improvements in ma-*

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* Mr. Bland, of Sydney, recommended (without patenting) the same process, three years ago.—See *Mech. Mag.* vol. xlviii., p. 273.

chinery for obtaining motive power. (A communication.) Patent dated June 19, 1850.

The present improvements have reference to that class of machines for obtaining power, in which the muscular exertion of a horse or other animal is applied, through the intervention of an endless travelling floor, to give rotation to a shaft, from which the power is taken off and transferred to any purpose for which it may be required.

The stoppage of machines of this description is attended with these inconveniences—that either the mechanism itself is liable to be deranged, from the sudden application of a check sufficient to overcome the resistance of the fly-wheel when in rapid motion, or that the horse is in danger of being thrown down and injured, if the stoppage be not instantaneous

As a remedy for these contingencies, it is proposed to hang the fly-wheel on a hollow shaft, free to revolve on the driving-shaft, and provided with a ratchet-wheel, which is to be set in motion by means of a click or paul in the interior of a cylindrical case keyed on the main shaft, and within which the hollow shaft and its appendages will thus revolve. The result of this arrangement will be, that when the horse stops and motion is no longer communicated to the driving-shaft, the click will cease to actuate the ratchet-wheel on the fly-wheel shaft, and the latter will continue to revolve with a gradually decreasing velocity, until its momentum is exhausted. As soon as the horse again begins to move, the paul will take into the teeth of the ratchet-wheel, and restore to the fly-wheel its original speed.

Claim.—Making the fly-wheel of such machinery, with its appendages, independent of that part of the mechanism which is acted on by the animal, so that when the horse or other animal and the travelling endless floor are stopped, the fly-wheel and its appendages may continue to rotate, without inconvenience, or risk of deranging the machinery.

CHARLES GREENWAY, of Green-street, Grosvenor-square, Middlesex. *For improvements in ships' and other pumps, in anchors, and in propelling vessels.* Patent dated June 19, 1850.

Mr. Greenway has discovered, since the sealing of his patent, that his improvements "in propelling vessels" have not that degree of novelty they were then supposed to possess; he therefore disclaims those words of his title, and introduces the word "and" between "pumps in." His title, therefore, now stands "Improvements in ships' and other pumps, and in anchors."

The improvements in pumps relate to their valves, which are so constructed as to present the appearance of a series one within the other, by which means two or more separate and concentric streams of water may be raised in the barrel at the same time.

The improvements in anchors consist in forming them of a number of plates, each of a complete form, which are either riveted, bolted, or stamped together; the last operation being performed whilst the plates are at a welding heat. When the plates are not permanently secured together, it is proposed to introduce between each a thin sheet of zinc.

Claims.—1. The mode described of constructing ships' and other pumps.

2. The modes described of constructing anchors.

CHARLES HANSON, of Stepney, Middlesex engineer. *For certain improvements in steam engines, steam boilers, and safety valves, and in apparatus and machinery for propelling vessels.* Patent dated June 19, 1850.

The improvements here claimed are—

1. Constructing the pistons and piston-rods of steam-engines, in such manner that the pistons may be brought closer together or moved further apart; the object of this arrangement being to facilitate the working of the steam expansively.

2. A peculiar construction of valve regulator, to be substituted for the eccentric, whereby the strap friction consequent on the employment of the latter, will be entirely removed.

3. An arrangement of expansion gearing for regulating the length of motion of the piston and slide valve.

4. A condenser, which consists of a casing with cells or chambers, having finely perforated partitions, set in a second casing, through which water is allowed to pass, or provided with pipes which also serve for the passage of water.

5. The construction of steam-boilers, with one or more smoke pipes passing through the box of the boiler into a red-hot chamber in the furnace, and thence to the vapour pipe in the boiler.

6. An improved safety-valve, with a tube provided with a plunger, connecting-rod, and regulating buffer, and set in the top of the steam chest, immediately under the lever of the safety-valve.

7. A marine propelling apparatus, having one or more blades moveable on their centres, in a frame sliding in suitable guides attached to the stern post, or other woodwork of the vessel, which frame has a backward and forward motion given to it by the direct action of the engine. Also, an arrangement of apparatus for setting and retaining the blades

in an angular position, during either the outward or inward stroke, and for changing their relative angular position as soon as the motion of the frame is reversed.

Gaspard Malo, of Dunkirk, France, shipowner. *For certain improvements in propelling vessels.* Patent dated June 20, 1850.

Claims.—1. The employment, for propelling vessels, of a screw composed of a number of folding and expanding vanes or wings, as described.

2. An improved bearing for the ends of screw-propeller shafts, as described.

3. The strengthening of the apertures made in the dead wood for the screw and end bearings, by means of a metallic framing, as described.

4. The employment, in aid of the air-pump in screw-propelled vessels, of two water tanks, as described.

John Hunt, of Stratford, Essex, engineer. *For improvements in forming and moulding plastic substances, and the machinery and apparatus employed therein.* Patent dated June 20, 1850.

Claims.—1. The forming and moulding of plastic substances into tubing, or covering or coating for wire, or mouldings, or beadings, or other articles, by means of machinery and apparatus constructed and arranged so as to afford a constant and continuous supply of the plastic material.

2. The machinery described for cutting moulds (in many of its parts similar to Nasmyth's shaping machine.)

3. The machinery described for the manufacture of bevel wheels and pinions. [The last machine slightly modified.]

4. The manufacture of bevel wheels and pinions from plastic substances by the method first described.

William Saunders, of the firm of Randell and Saunders, of Bath, Somerset, stone merchants. *For improvements in sawing and sawing machinery.* Patent dated June 20, 1850.

Claims.—1. A method of sawing stone before removal from the quarry or other natural site, and the machinery used for that purpose as shown and described; that is to say, in so far as regards the mode of bringing the machine to its work, the centering of the saw frames and the crank shaft by which they are actuated, on one and the same axis, certain arrangements for driving the saws from one end only, and a manner of fixing the saws whereby each may in its movements neither affect nor be affected by the movements of the others or any of them.

2. A balanced saw-frame as represented and described, in so far as respects the centering of the sawing-frames and crank-shaft on one and the same axis, and the balancing of the working parts in the manner described.

3. A handsaw machine represented and described, in so far as regards the combination of the balanced frame and inner vibrating frame, with the hand-turning apparatus.

4. The application of the method or methods and machines aforesaid, all or any of them, to the sawing of wood or any other substances to which the same may be applicable.

Henry Stephens, of Stamford-street, Blackfriars-road, writing-fluid manufacturer, and Edwyn Wylder, of Paddington, Middlesex, mechanist. *For certain improvements in ever-pointed pencils, pens, and pen-holders.* Patent dated June 24, 1850.

The improvements here claimed are—

1. (In respect of "ever-pointed pencils"). 1. The employment of an internal helix in lieu of a propelling screw, by means of which a length of black lead, chalk, or other marking materials may be propelled nearly the whole length of the pencil.

2. (With reference to "pens"). 1. The application of gutta percha to metal pens, between the shoulder and the nibs, the metal having been first reduced in thickness, either by grinding or otherwise, for the purpose of obtaining greater flexibility. 2. The construction of barrel and other pens in metal, to be used with fountain pen-holders, having the barrel placed the reverse way, or above instead of below the nibs.

3. (With respect to "pen-holders"). 1. The use and application of glass to telescopic and other fountain holders, whereby the ink is kept from contact with metal, until it reaches the pen. (Query, Has not this been anticipated by Mr. Thomson's patent?) 2. The adaptation of a band of flexible material to fountain holders, for the purpose of facilitating the flow of ink to the pen, such band being placed around a part of the tube, in which air-holes or openings have been previously made. 3. Various constructions of hydrostatic pen-holders, or those in which the ink is delivered from the reservoir by its own gravity, whereby its flow is regulated and controlled.

Edward Mitchell, of Great Sutton-street, Clerkenwell, gentleman. *For improvements in fastenings for articles to be used for writing and drawing, and other purposes; and improvements in articles to be used for writing and drawing.* Patent dated June 24, 1850.

Mr. Mitchell describes his improved fast-